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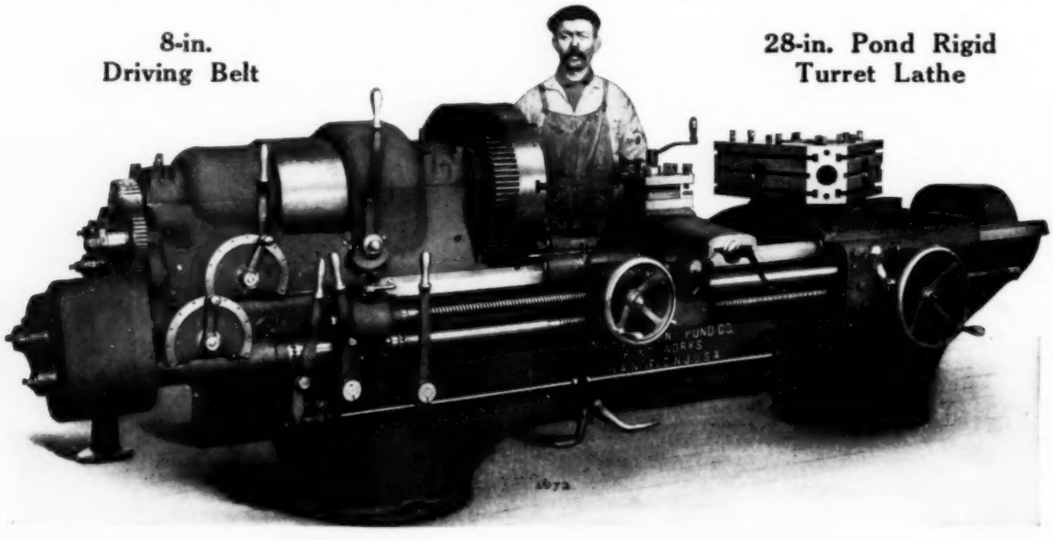

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(*See pages* 43, 44, 45 and 46)

A Boring Mill Builder's Methods

By F. A. Stanley

Some of the special ways and means devised by a builder of vertical mills for producing different parts of his machines with accuracy and economy.

A set of jigs and fixtures for machining the elements of a self-releasing, ratchet crank handle for feeding the heads; simple grinder equipment of ball centers and special arbor, for finishing the crowned steps of cone pulleys; methods of hobbing worm segments in the miller and planing internal spiral grooves with the aid of the dividing head.

The manufacturing, erecting and tool departments of the King Machine Tool Company's shops at Cincinnati, Ohio, contain many features of interest, particularly in the line of special equipment and methods used in the construction of their vertical boring and turning mills and vertical turret machines. A number of these special tools and processes, which are indicative of the thoroughness with which the entire plant is equipped with facilities for the turning out of its product, are illustrated by the accompanying halftone and line engravings. The views here presented will be supplemented by others in subsequent issues of this journal, as it is impracticable to compress within the limits of a single article all of the material which has been secured with a view to illustrating typical methods and devices in this plant.

A Set of Jigs and Fixtures

A complete set of fixtures is shown in Fig. 1, for milling and drilling ratchet cranks for operating cross feed screw and feed rod, by hand. One of these cranks complete will be seen at *A*, Fig. 1, with a ratchet sleeve upon which it is used, at *B*. Details are given in the drawing, Fig. 2, and it will be noticed upon reference to this engraving, that the crank proper, *A*, is pivoted in a casting *C*, known as the crank hub, which is bored out to fit over the cylindrical body of the ratchet sleeve *B*.

At the inner end of crank *A* there is a lug *D*, that is adapted to engage the notches in the periphery of sleeve *B* when the crank handle is pressed inwardly, against the action of spring *E*; this enables the crank to operate the ratchet sleeve and, through the sleeve, the feed screw. When the pressure of the hand is removed from the crank, the spring *E* throws the lug on the crank out of engagement with the ratchet sleeve and the crank then hangs free without danger of revolving during power operation of the feed.

Machining the Crank

The ratchet crank *A* is a steel casting. For milling the two faces that fit between the jaws of the hub *C*, a double-end fixture *F*, Fig. 1, is employed. Here two rough cranks are secured at opposite ends by the clamps shown and the work is then passed between straddle milling cutters, which bring the crank ends to the desired thickness. This milling fixture, like the others illustrated, is located upon the miller table by means of a tongue at the bottom.

The jig *G* is a combination milling and drilling tool. When utilized as a milling fixture it stands upright, as represented, with the ratchet crank held in the seat at the upper end, while the rectangular lug is milled at the end of the crank. For use as a drill jig, it is placed upon its side, resting on the bearing surfaces indicated, while the hole is drilled through the head of the crank for the pin by which it will later be pivoted in the crank hub *C*.

A Hollow Milling Operation

The different views of the crank show a small, cylindrical projection which receives and locates the free end of the spring *E*, that normally holds the crank

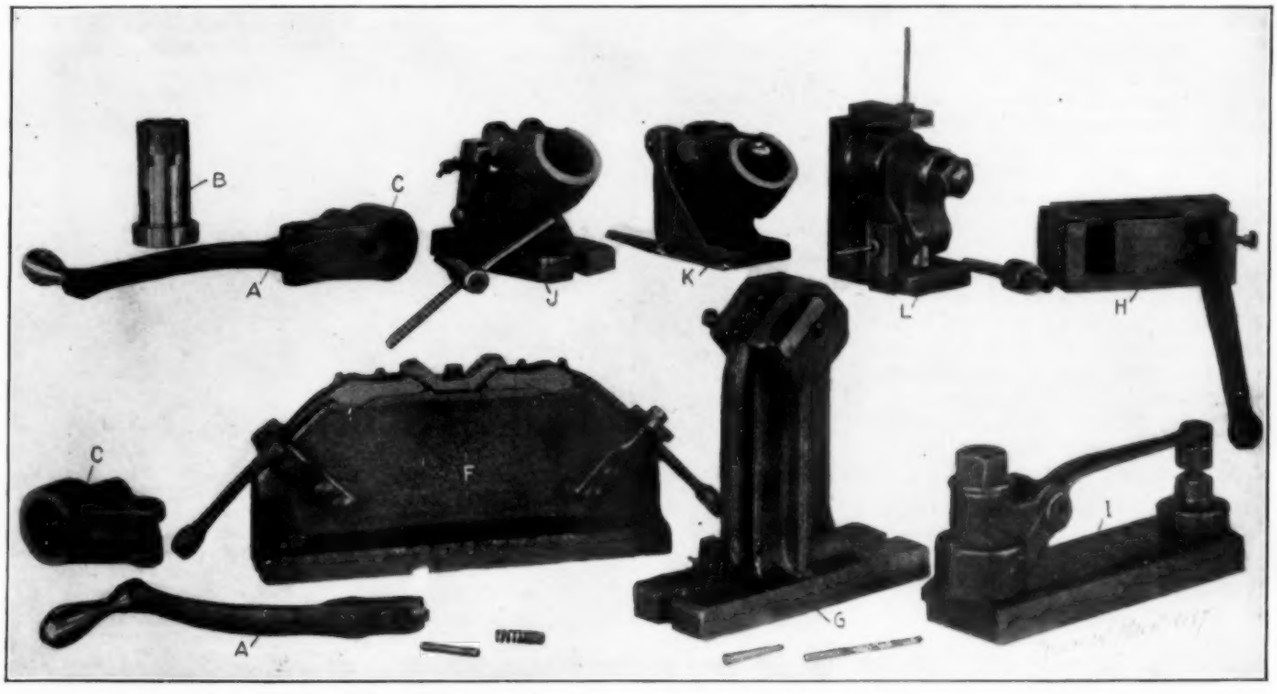


Fig. 1. Jigs and Fixtures for Ratchet-crank Handles

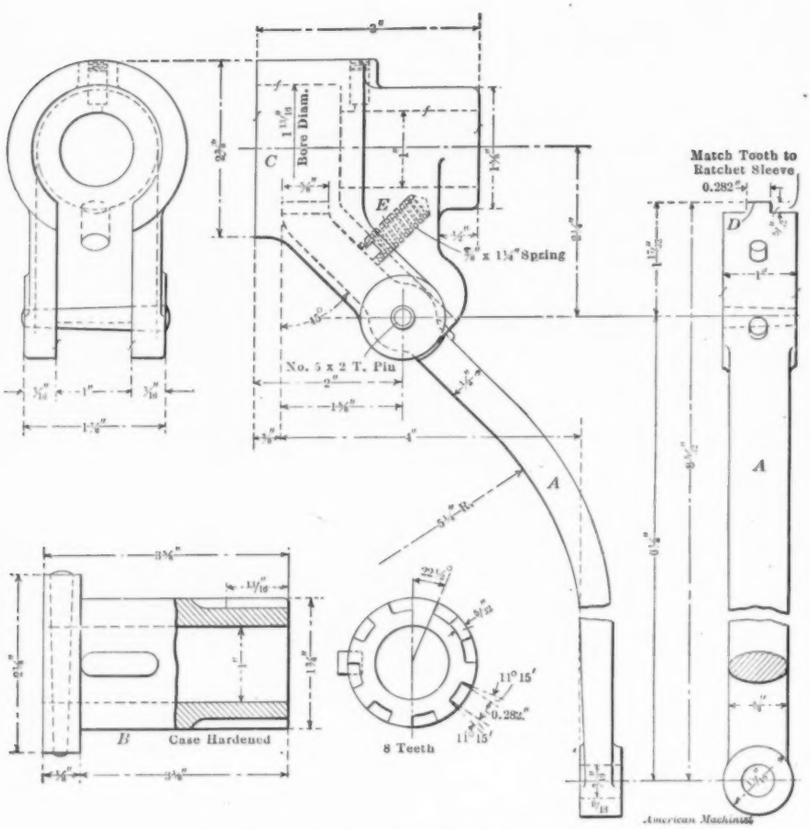


FIG. 2. FEED RATCHET-HANDLE DETAILS

out of engagement with the ratchet sleeve. This pin-like lug is machined to diameter in a jig *H*, by means of the hollow mill seen to the left of the jig. The work is slipped into a seat formed in the jig and is held there upon a pin slipped through the pivotal hole drilled in jig *G*. The hollow mill fits a hole in the guide plate attached to the top of the jig, and a stop collar on the mill determines the depth to which it shall be fed.

The jig has two different sizes of openings to receive two sizes of cranks, which differ principally in the width of the head where it fits in the jaws of the crank hub. The same locating pin is applied in both sizes of cranks and the one hollow mill answers in both cases. The jig at *I* holds the assembled crank for the drilling of the hole for the handle, at the outer end. Here the hub is placed over a locating stud and secured with a nut, and the end is rested upon an adjustable support while being drilled. In actual operations under the drill press, the work is further held by a strap bolted to the table of the machine.

MILLING AND DRILLING CRANK HUBS

Before the crank hub *C* is milled, it is chucked out and faced in the turret machine; it is then ready to be placed in the fixture *J*, for the milling of the opening between the jaws to receive the crank *A*. An inclined stud in the fixture holds the work at the necessary angle and screws at the sides locate the piece square and steady it under the action of the cut.

Following the milling of the jaw opening the hub is placed on another inclined locating plug in the jig *K*, a swinging bushing carrier is snapped down into the milled seat in the work and the hole is drilled for the spring *E*, Fig. 1. The jig *L* locates the work upon a horizontal stud and holds it true with the milled jaw opening by a guide block attached to the jig base. With the aid of this jig a hole is drilled through the cylindrical wall of the hub to receive a spring plunger; and, with the jig turned on its side, the crosswise hole for the taper pin for holding the crank is put through the jaws.

GRINDING CONE PULLEYS

An unusual operation is illustrated by Fig. 3, which shows a large, five-step cone pulley as finished on a Norton plain grinding machine. The pulley is roughed down in the lathe to within about 1/32 inch of size and is then mounted on an arbor *M*, Fig. 4, where it is held endwise by the round nut and driven by the key near the other end. This arbor has spherical centers fitting the ball centers *N* and *O*. The former is carried in the head spindle and the offset center *O* in the tailstock. Adjustable center *O* is set off center as far as required to suit the crown to be given the pulley faces, the ball centers providing a true bearing for the arbor at any angular position.

The disk in which ball center *O* is carried is mounted upon the flanged head of the taper shank in such a way that it may be rotated half way around from the position in which it is represented and again clamped fast by the binding bolt, the two notches in the edge of the disk serving as indexing points for the two settings. With the adjustable center set to the rear of the true center line of the headstock and tailstock, so as to set the arbor out of alinement, one side of the crowned face is ground on each step of the pulley; then the disk carrying the

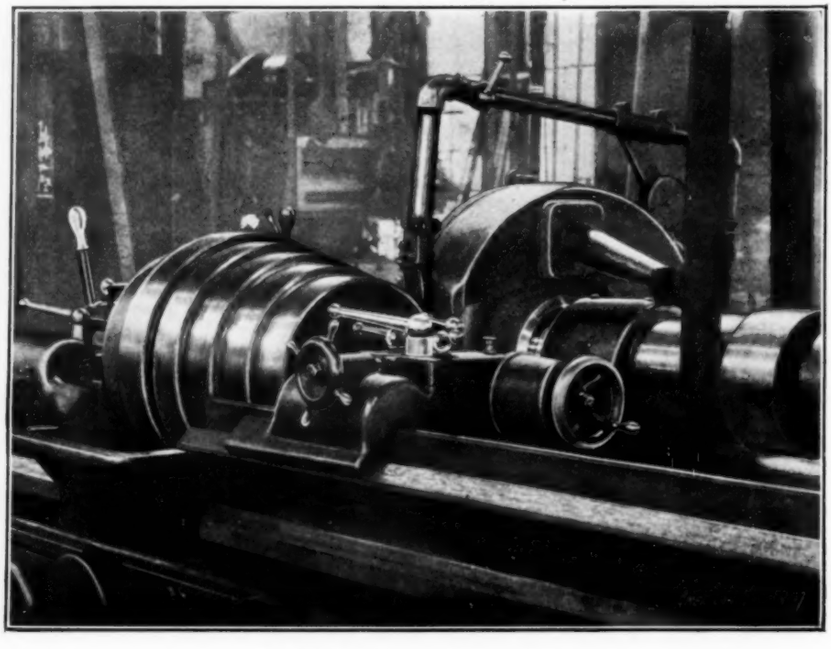


FIG. 3. GRINDING CONE PULLEYS

center *O* is turned half way around, bringing the ball center to the front of the true center line and the other half of each step is ground, thus finishing the crowning of the faces.

A Hobbing Operation

Fig. 5 shows a method of hobbing a large worm-gear ring on the milling machine, with the work mounted upon a special face plate attached to the dividing head. This is the means devised for hobbing the teeth in worm segments for the swiveling heads of the boring mills; the gear after it is hobbed as a complete ring being cut at three points to form segments of 120 degrees each. A detail of a segment is presented in the line engraving, Fig. 6.

The ring is faced, and turned outside and in, and drilled to fit on the faceplate on the dividing head. The teeth are first gashed and then the hob is applied for

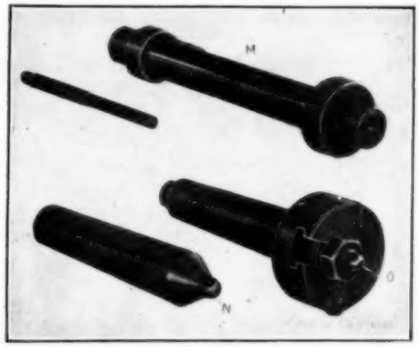


Fig. 4. Arbor and Ball Centers for Grinding Pulleys

finishing to form and depth. As will be noted from the data on the drawing, the wheel is nearly 28 inches in diameter and is hobbed for a single thread worm 1½ inches in diameter with a lead of 0.333 inch. Two of the worm shafts with squared ends by means of which the segments are operated in setting the swivel heads, are in Fig. 5, seen lying upon the gear ring.

Planing a Spiral Groove on the Miller

Another interesting operation performed on the milling machine is represented by Figs. 7 and 8 which show how an internal spiral groove is cut in a friction operating sleeve by using a planing tool in the milling machine. The nature of the work will be appreciated upon examination of the drawing, Fig. 8; one of the sleeves will also be noticed resting upon the miller table. The two left-hand spiral grooves have to be cut exactly opposite each other in the sleeve; they are ¼ inch wide at the bottom and the sides form an included angle of 29 degrees.

The work is mounted on a faceplate fixture with quick-acting clamps and the seat in which it is centered, provides clearance for the cutting tool when passed

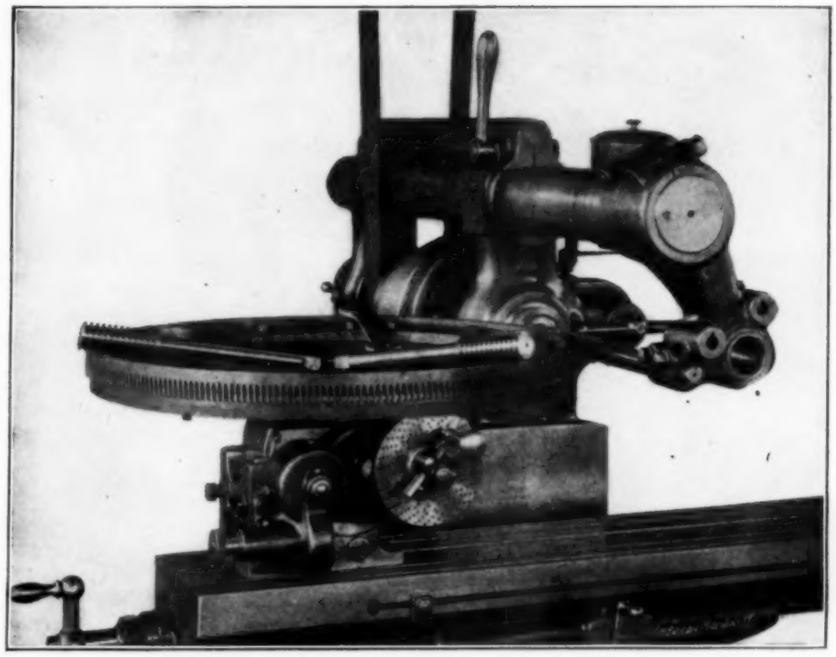


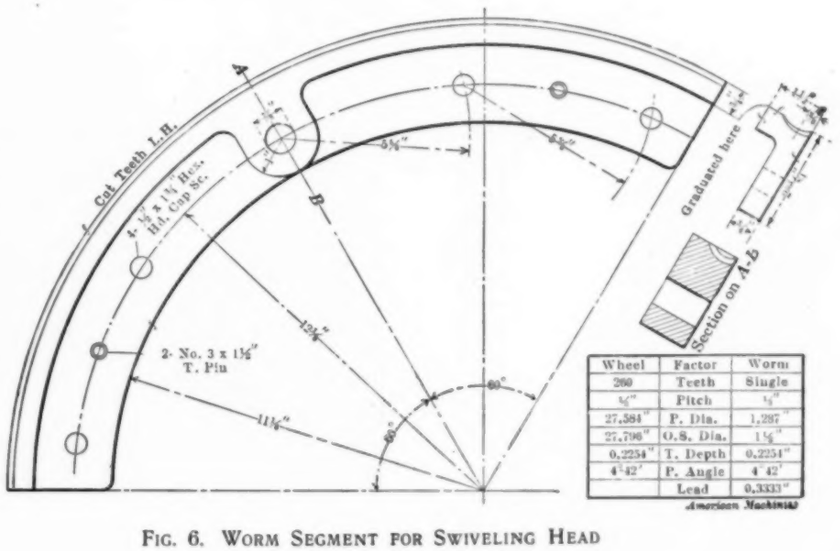
Fig. 5. Hobbing in the Milling Machine

through the work. The tool is held in a short bar projecting from a special arbor in the machine spindle, and the spindle is locked to prevent the tool from being displaced from its proper position with one edge coincident with the horizontal center line of the sleeve. The machine once set up, it is a simple process to plane in the spiral grooves. The work is passed to and fro over the cutting tool by operating the spiral head through the crank handle for the table feed. The feeding for depth of cut at each successive stroke is accomplished by operating the table cross feed.

Indexing for the two groove positions is accomplished in the customary manner. After the grooves are well roughed down it is an easy matter to put another tool in place and take the requisite finishing cuts. Several of the cutting tools for different sizes of friction operating sleeves, are shown in front of the sleeve resting on the table. The method of attaching them to the holder is obvious.

Gear Cutting Arbors

The foregoing references to milling-machine operations lead naturally to a consideration of certain features of the gear-cutting department, and in this connection, one view, Fig. 9, is presented as emphasizing the characteristic liberality with which the machines in this department have been fitted up with desirable accessories. The engraving shows a set of arbors for one gear-cutting machine, and every arbor in the group is solid and used without bushings. The bodies are ground to the required diameters and



Wheel	Factor	Worm
260	Teeth	Single
¼"	Pitch	¼"
27.584"	P. Dia.	1.287"
27.796"	O.S. Dia.	1½"
0.2254"	T. Depth	0.2254"
4°42'	P. Angle	4°42'
	Lead	0.3333"

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Fig. 6. Worm Segment for Swiveling Head

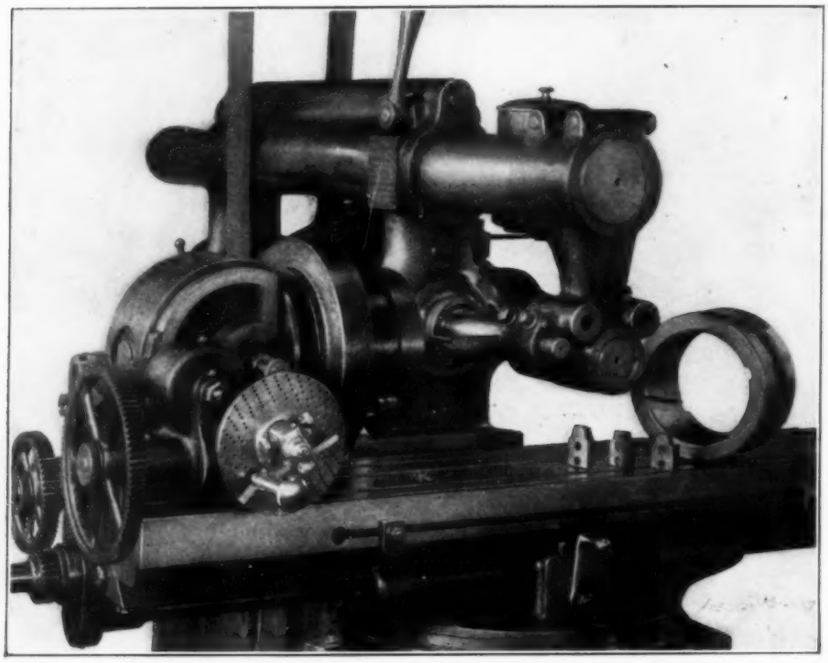

FIG. 7. PLANING INTERNAL SPIRAL GROOVES ON THE MILLER

range from 1⅛ inches to 3⅜ inches; the sizes included covering all the work handled on this particular machine.

GRINDING INDEX RINGS AND LOCK BOLTS

Fig. 10 represents the method of grinding the sides of the notches in the hardened indexing ring of the turret used on the King vertical turret machine. Details of the ring, locking bolt, gibs, are shown in Fig. 11. One side of each index notch is radial; the other side is at an angle of ten degrees to a line drawn parallel to the radial side. The end of the index bolt or index pin is ground to the same angle on the side, while the top is ground off at the end to an angle of five degrees to conform to the angle at which the turret is mounted upon its slide.

Details of the grinding fixture will be seen in Fig. 12, and the construction will be understood from this drawing and the general view in Fig. 10. The base *A* is provided with one V to rest on the table of the surface grinder and is bored out to receive the hub of the index plate *B*, which in turn is bored to carry the member *C* that serves as a seat for the work. The index plate *B* is provided with five hardened and ground bushings *D*, which are fitted from the underside and adapted to receive the conical end of the index plunger *E*. This pin is carried vertically in the opening *F* in base *A* and is operated by a shaft *G* which has at its inner end a pinion engaging with rack teeth cut in the side of the index plunger. As illustrated in the halftone, Fig. 10, there is a nurled knob upon the outer end of shaft *G* by which the index plunger is withdrawn. A compression spring inside of the index pin normally keeps the plunger engaged with the index plate above.

OPERATION OF THE FIXTURE

In Fig. 10 a turret indexing ring is represented in place in the fixture, ready for grinding in the notches. At the side

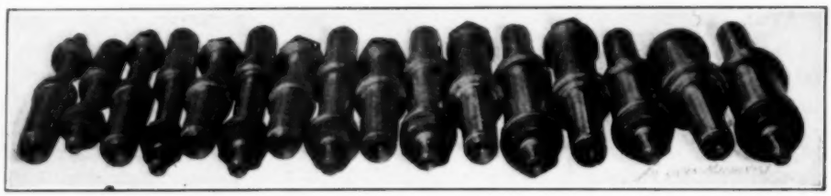

FIG. 9. A SET OF WORK ARBORS FOR ONE GEAR CUTTER

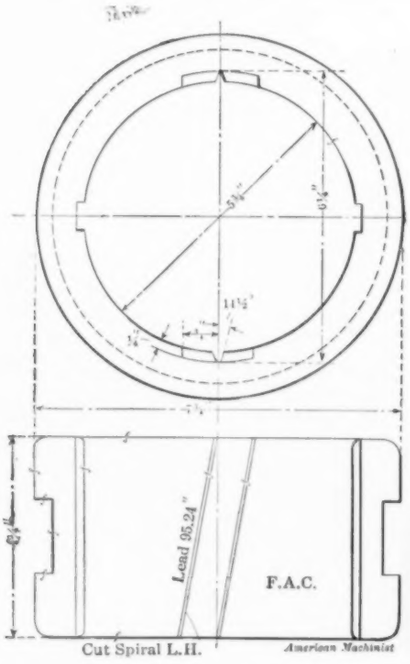

FIG. 8. DRIVE FRICTION OPERATING SLEEVE

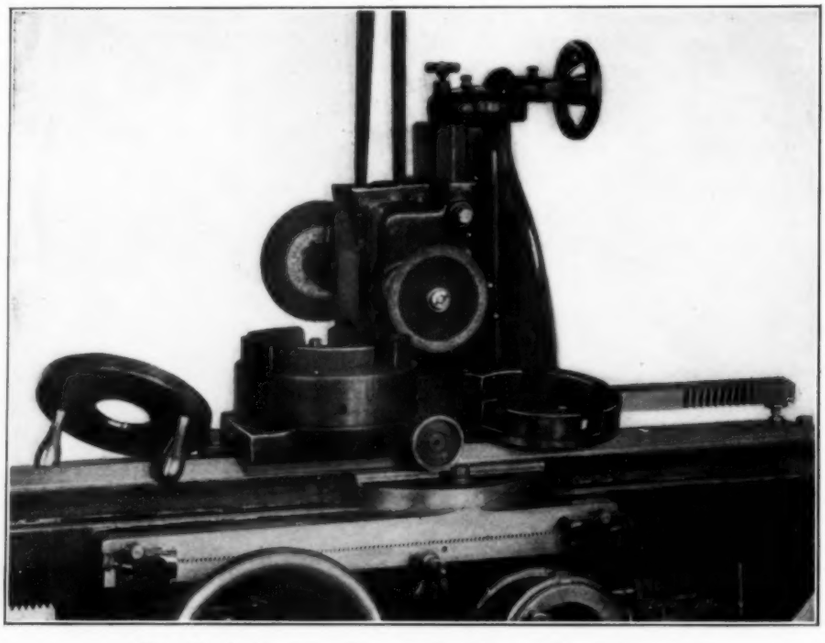

FIG. 10. A GRINDING FIXTURE FOR TURRET INDEX RINGS

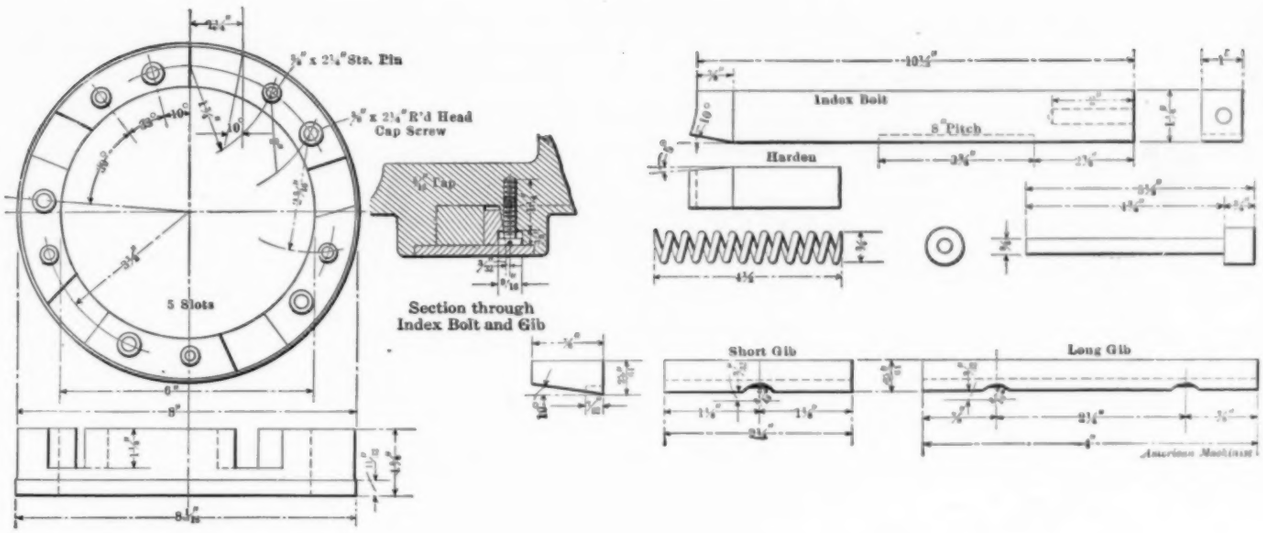

FIG. 11. TURRET INDEXING RING, LOCKING BOLT AND GIBS

a finished ring is seen with a locking pin resting with its working end in one of the index notches.

The fixture is first set for grinding the radial faces of the notches, and indexed from one to another until these faces in the series of notches have been ground; then the table is swung around for the angular side of the notch and the work fed in to give the required width of opening. The indexing is proceeded with as in the case of the radial faces.

In setting for the radial grinding operation, a plug with a sharp, conical point at the end, is slipped into a central hole in the work-carrying plate of the fixture, and a straight-edge can then be placed along the side of the notch after this has been ground clean by the wheel, and if truly radial the straight-edge will coincide with the point of the centering plug.

The index bolt for the ring is ground all over, and is brought to the correct slope at the end by holding it in a form of vise that may be adjusted to give any desired angular position.

The disk with two handles, shown near the end of the surface-grinder table in Fig. 10, is a gage of the same diameter as the turret index ring and is used for testing the diameter of the seat bored in the turret to receive the ring. It is lightened by the large opening at the center and by a recess turned in the back face of the disk.

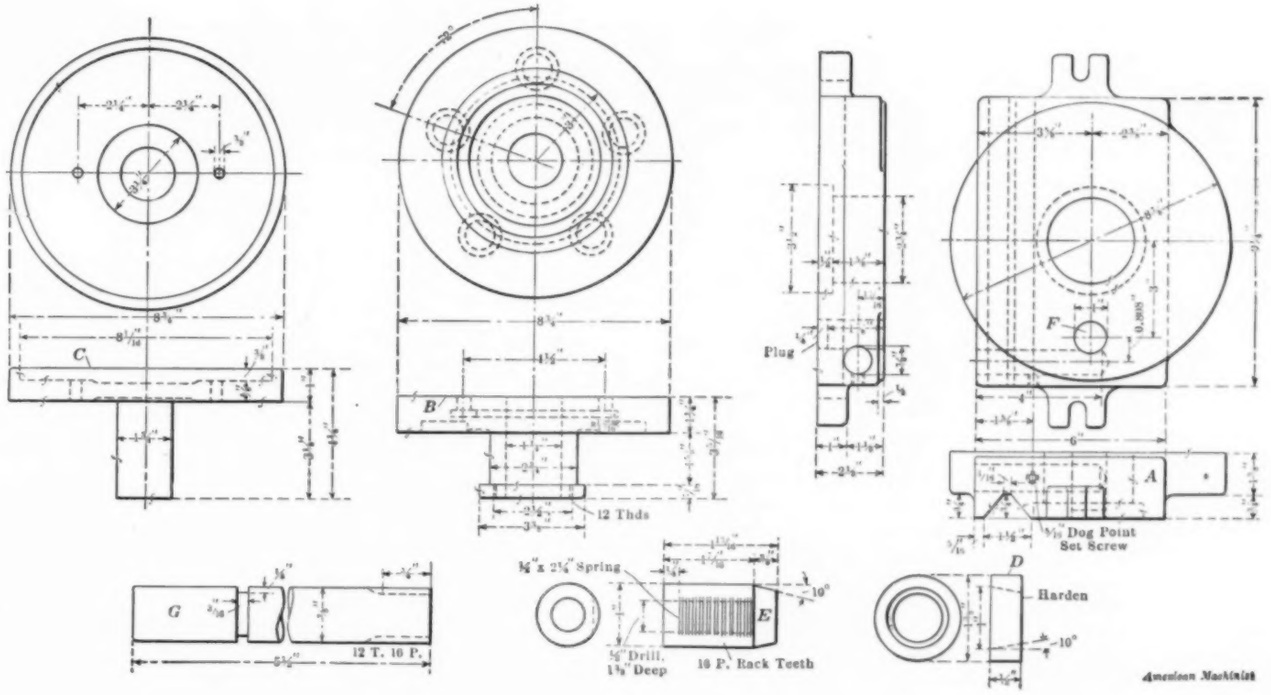

FIG. 12. DETAILS OF GRINDING FIXTURE FOR TURRET RINGS

Which Way Shall We Cut End Mills

Special Correspondence

Interesting opinions both by makers and users, regarding the proper way to make the cutting edges of end mills.

The old way of a left hand spiral on a right hand mill, gives a negative rake to cutting edge, but does not tend to draw out of the spindle.

The proposed method gives a better cutting rake, but tends to draw the cutter out, unless held in by a draw-in box, which is becoming more generally used every day.

It has long been a principle in making cutting tools for most metals, to give a top rake to the cutting tool, whether it be a diamond-point lathe tool, or the cutting lip of a drill. But this seems to have been laid aside (for another reason) in the case of the end mill by many cutter makers, as can be seen from the fact that they make right-hand mills with a left-hand spiral and left-hand mills with a right-hand spiral, giving a negative instead of a positive rake to the cutting edge as can be seen in Fig. 1.

When the end mill is used so as to cut on the end, as the name implies, as in Fig. 2, there would seem to be little question in regard to the effect of the positive or negative rake. Some believe this to be the use to which the end mills are usually put and the condition which should govern the direction of the spiral flutes. Fig. 3 shows an end mill with spiral of the same hand as the cutter.

If the mill is used for side cutting, as in Fig. 4, the direction of the spiral has no influence on the cutting qualities. It is this use of the end mill, however, which seems to have determined the direction of the spiral, as the "opposite" spiral, i.e., a right-hand spiral on a left-hand mill, tends to force the arbor of the end mill back into the milling-machine spindle, while the "same hand" spiral, i.e., a right-hand spiral on a right-hand mill, will tend to draw the arbor out of the spindle.

While this tendency to draw out of the spindle has doubtless been the cause of many broken cutters, especially when long and slim end mills have been used as side mills, modern practice is to use the draw-in rod in all except the smallest work and in this case the taper end of the arbor is usually so much larger than the diameter of the cutter that it will never pull out if well fitted. And when the draw-in rod or other positive holding devices are used, this objection to the "same hand" spirals disappear, apparently leaving only the advantage of the better cutting angle for end work.

This matter was brought to our attention some months ago by John McGregor, president of the Union Twist Drill Company, Athol, Mass. This company has been making special end mills with right-hand spirals on right-hand mills for some time, with considerable success and it was thought that the experience of both makers and users ought to be of value to all concerned.

Considerable correspondence with both cutter makers and users reveals decided differences of opinion, the older makers in nearly all cases favoring the "opposite" or old spiral, while for the most part those who have come into the field in later years, favor the other plan. The increased difficulty of milling the end flutes on account of the undercutting, is given as one objection, but some makers inform us that this presents no practical difficulty and that either style goes through the shop without any trouble whatever.

We quote from several makers, some of whom prefer to remain nameless, on both sides of the question in order that all points may be brought out.

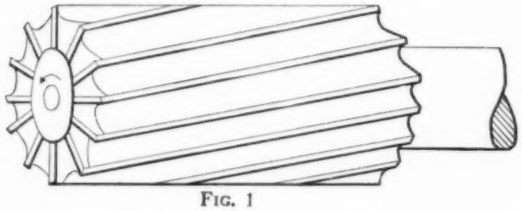

FIG. 1

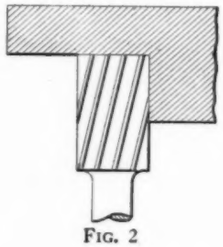

FIG. 2

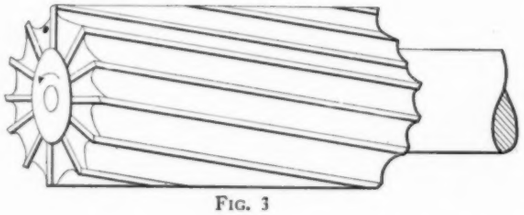

FIG. 3

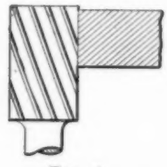

FIG. 4
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WHICH WAY SHALL THE FLUTES BE CUT?

MAKERS FAVORING THE "OPPOSITE SPIRAL"

We believe if your correspondent had attempted to use right-hand end mills fluted with a right-hand spiral, he would readily see why left-hand spirals are cut on the right-hand mill. The tendency, of course, is to pull in on the principle of a right-hand screw, and is not at all satisfactory for general work; consequently, the practice among all makers of end mills and tools of a like character, is to give them the opposite spiral to that of the cut.

PRATT & WHITNEY COMPANY.

The deciding reason for making left-hand mills with right-hand spirals and right-hand mills with left-hand spirals, has been to have the cutting action such as to force the mill back into the spindle rather than to draw it out. It has been thought that the difference in character of the cut, if any, is not sufficiently in favor of the other type of cutter to offset this important consideration.

While our general experience would lead us to the above conclusion we were sufficiently interested since receiving your letter to take two end mills, one of each type, grinding them under exactly the same conditions and making some test cuts in a steel block. We found that the commercial mill cut fully as well as one made as recommended by your correspondent, the result being the same whether the cut was deep or shallow. A very slight difference in the grinding seems to affect the result much more than any difference in the angle of the tooth.

It might be added as another reason why the end mills are made as they are, that they are easier to manufacture as the cutting of the end teeth does not require an under cut as would be the case if the

spirals were made the same hand. This, however, is not the reason determining that the cutters shall be made as they are. Our experience, as well as the test just mentioned, go to show that the cutting qualities of the end teeth are fully as good with the present style as with those made the opposite hand.

BROWN & SHARPE MFG. COMPANY.

The question of making right-hand end mills with left-hand spiral, and *vice versa*, has been brought upon previous occasions, but it has always been the consensus of opinion among the majority of our customers to whom this matter has been submitted from time to time that it is less objectionable to make them this way than the other, since if they are used for milling on the side of a piece of work or in a slot without bottom the right-hand spiral mill has a tendency to pull the tool out of the socket.

We have only been making spiral end mills for stock for about one year. We have made no extensive canvas of tool users regarding the use of the end mills, but followed the Brown & Sharpe practice. It is safe to say that 95 per cent. of the end mills used are broken by what we call "hogging in." This is sometimes due to back lash in the feed, also by feeding the wrong way. Teeth with spirals of the same hand will be undercut, which is harder to make than the other, and is also a weaker tooth. Any spring to this tooth will make it hog in. We admit that the "opposite" spiral presents what is called lagging cut, that is, the "rake" is negative where the extreme corner is cut. In the case of Fig. 3, we do not think a spiral mill is at all necessary for this work. In our own practice for all such work we would use straight teeth. We recommend spiral mills for work like Fig. 4. In either of these figures the shape of tooth like Fig. 3 would work quite satisfactorily, except in cases where the chips could not get out of the flutes. In the latter case Fig. 1 works at a disadvantage as compared with Fig. 3.

It was the custom some years ago to recommend spiral mills for all widths of cut over 1 inch, and the writer thinks this is a good rule to follow.

Your correspondent seems to think that Fig. 2 represents the large majority of work done with end mills, while in my experience I should say the majority of work would not have a depth of cut more than ⅛ inch, and of course, a spiral mill is not needed for any such depth of cut. The tendency to force the mill back into the spindle I think is so slight and is so greatly overbalanced by the loosening action obtained by trying to cut with the mill running slightly out of true that it can be entirely neglected when comparing either right- or left-hand spiral as in the case hand cut. End mills can rarely be held in the taper without the aid of a bolt screwed into the shank when there is any leverage on the mill due to its running out of true or extremely long lengths.

MAKERS FAVORING SAME HAND SPIRAL

It has been the writer's experience that best results are obtained from spiral cutters when the tooth entering the stock presents a shearing edge, in exactly the same way as a lathe hand would sharpen his lathe tool for use in a lathe, or as a planer hand would sharpen his planer tool. It is true that occasionally we may meet with customers who insist upon having their teeth spiraled in the opposite direction for the purpose of preventing dropping of the cutter while in action, or in other words, for keeping the shoulder of the spindle against its end bearing.

A cutter with the teeth pushing the chip off downward will rise and fall with the varying degree of pressure, a heavy cut tending to push the cutter upward and on a light cut the weight of the spindle counteracting the upward push of the cutter, so the cutter will develop a vibrating action, which is in most cases undesirable. A tooth which enters the material properly sheared will pull the chip away and relieve itself while a blunter cutter with the spiral running in the opposite direction will push the chip instead of cutting it off.

With a diamond point the chips will be large and clean cut. With an obtuse point the chips will look as though they had been chewed off, and will have the appearance of grains of powder rather than of chips.

In short, it has been our experience that the flutes of the cutter should have a tendency to hold the spindle downward so that the flat end of the mill will cut a smooth surface on the milled bottom. A variable upward pressure will leave a rough surface.

The question whether the mill is right hand or left hand does not seem to us to be of any importance. We understand that Brown & Sharpe make their spindles running left hand as a rule, while other milling-machine manufacturers have adopted the right hand. Of course, right-hand mills will be sheared exactly in the opposite direction from left-hand mills.

You will conclude from what we have to say above that we believe the action of the cutter in entering the material, should have a tendency to pull the cutter downward instead of pushing it upward.

BECKER MILLING MACHINE COMPANY.
Hyde Park, Mass.

Your correspondent believes that left-hand mills should have left-hand flutes. Of course, this is at variance with the standard adopted by the majority of cutter manufacturers. However, a number of our customers have ordered mills (more especially shell end mills) made that way.

Standard end mills with spiral flutes have right-hand teeth and left-hand spiral, or *vice versa*. This style, when cutting on the sides, forces the cutter into the socket and drives the bur down, which is an advantage when milling to a layout, as it leaves the line in plain sight. The end teeth do not cut freely on account of the negative rake. For end cutting, the straight-fluted mills will give free action, and are more commonly used for this purpose.

Where a rake on the end teeth is required, the spiral is made left-hand for a left-hand mill or right hand for a right-hand mill. This style is used more on shell end mills. Briefly, the spiral is made to conform with the requirements of the end teeth, or *vice versa*.

SOME USERS WHO FAVOR "SAME HAND" SPIRAL

"We would state that we have given these end mills a very thorough trial and they have proved satisfactory in all respects.

"While it is unusual for small tool manufacturers to make end mills in this manner, yet we feel that it is the correct way, the only thing to guard against being that the Helix angle be not greater than 10 degrees, so that the mill will not have a tendency to withdraw from the collet or chuck.

REMINGTON ARMS COMPANY.
Illion, N. Y.

"Regarding right-hand mills with left-hand spiral, and left-hand mills with right-hand spiral, will say that we have for some time been making our right-hand mills with a right-hand spiral and our left-hand mills with left-hand spiral, and we find that these mills work better than the style we used to make with the spiral running the opposite way from the cut.

"We find these especially advantageous on our cam-cutting department. Our end mills have the shanks ground so that we are assured of a good fit in the socket or spindle, and there is no appreciable tendency for the cutters to work out."

UNITED SHOE MACHINERY COMPANY.
"Beverly, Mass."

"I always have considered that the spiral of any end mill should be the same hand as cut. The advantage is obvious, as the opposite spiral would seem to carry the chips back and allow the mill to do better and smoother work. On the other hand, I can not overlook the advantages of present design with the use of shell-end mills, owing to their large diameters in comparison with the shank. It seems to me that shell-end mill arbors should be held in place by a draw bar and made as above stated. I say this, knowing the common use of shell-end

mill, which is used extensively for both face- and slab-mill operations. I think you are on the right track. "

L. H. SWIND.

"Philadelphia, Penn."

"We make end mills in our own tool room, and during the last three years we have adopted left-hand spiral on a left-hand mill, and a right-hand spiral on a right-hand mill, We always used to make them opposite of this, but have learned that we get better results by cutting them this way.

F. E. REED COMPANY.

"Worcester, Mass."

Turning Machine for Crank Pins

By I. W. Chubb

A vertical machine of English design adapted for small crank shafts which hold work and tools rigidly and has easily operated devices to insert and remove the work.

As makers of steam engines for various purposes the firm of Marshall, Sons & Co., Ltd., Gainsborough, England, naturally have many small cranks to turn. In the past this has been done in the usual way, but the firm were not always satisfied as to the accuracy of the method employed. For this reason they suggested a machine for single-throw cranks, intended solely for turning the pin after the shaft itself had been finished. A tool more or less of the lathe type, in which the shaft, clamped so that the pin runs true, turning on a horizontal axis, was readily suggested, but the vertical type was finally adopted. This decision was influenced by observation of the effect of crank pin turning at high-speed on the workmen employed in the process.

WHY A VERTICAL MACHINE WAS MADE

To the old speeds with ordinary carbon-steel tools the workmen were naturally well used. At the higher speeds, however, the crank shaft flying round much faster had a serious effect on certain of the men employed, rendering them nervous at work and leading in fact to trapped fingers and similar accidents.

The machine illustrated in back view by Fig. 1, was, therefore, constructed to the designs of George Richards, of the Richards Machine Tool Company, Sydenham, London, S. E. Here two cutting tools can be employed. The same type of machine may be obtained with but one tool and, therefore, having but one upright. The cranks, single-throw, as stated and usually from two to four inches diameter at the pins, have throws ranging from four inches up to eight inches.

The machine illustrated will take crank shafts measuring 66 inches from the middle of the throw to the end of the shaft, the latter extending if necessary below the floor level, the distance from the table top to the bottom of the machine being 58 inches. The shorter end upstanding, the turned crank shaft is secured in two places below the throw. The longer turned end is thus carried at the top in a jig, which varies according to the size of crank and which is fixed to the table and has set screws for some small amount of side adjustment. At the lower end the shaft is held in split bearings.

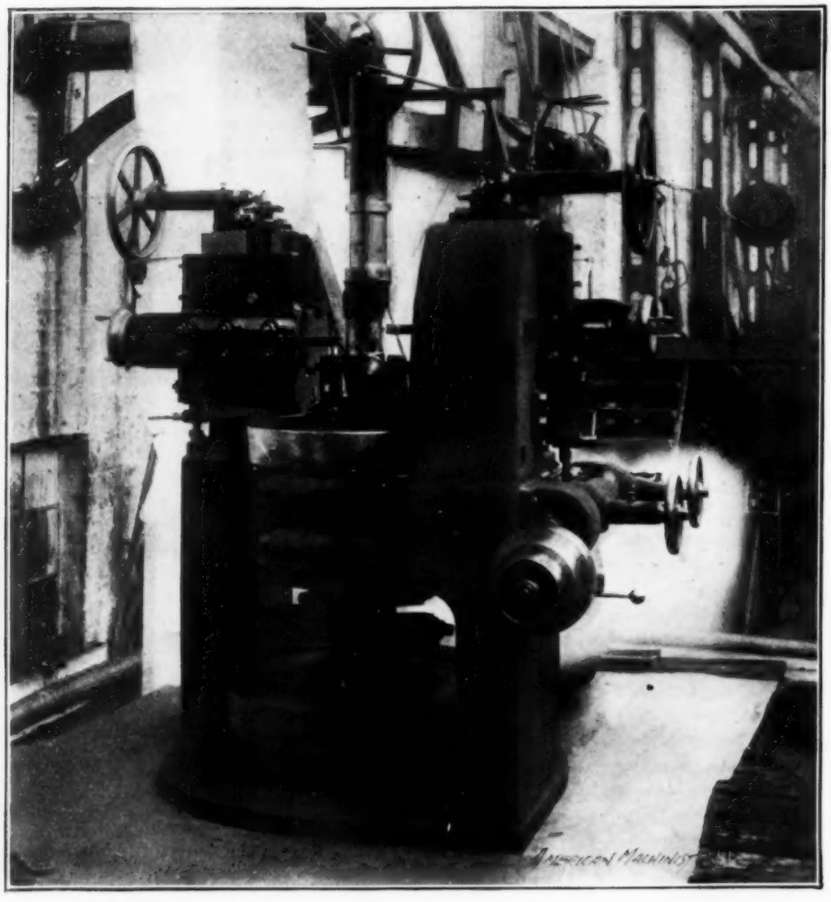


FIG. 1. RICHARDS' CRANK-PIN TURNING MACHINE

EASY TO CHANGE CRANKS

To remove the finished crank only four nuts have to be loosened and with crane overhead, this can be done and a fresh crank shaft secured in place in less than five minutes. The spindle of the machine measures 22 inches diameter and is perforated with six holes to suit the cranks.

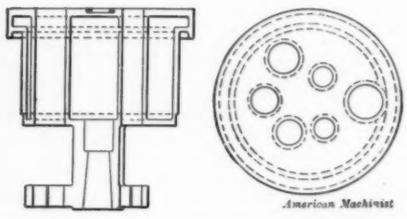


FIG. 2. DETAIL OF SPINDLE OF RICHARDS' CRANK-PIN TURNING MACHINE

The shaft, of course, passes right through the spindle, which at the lower end bears a set of shaft clamps. This should be clear from the detail given in Fig. 2. The spindle bearing is of white metal.

To change quickly according to the different operations, the drive is by variable-speed motor. The speed of rotation of the spindle is from 30 to 250 revolutions per minute, a range between roughing-out and polishing and lapping speeds. The drive is direct to a 30-inch pulley by six-inch belt without intervention of gearing, a right-angle drive with idlers being employed. The original intention was to use

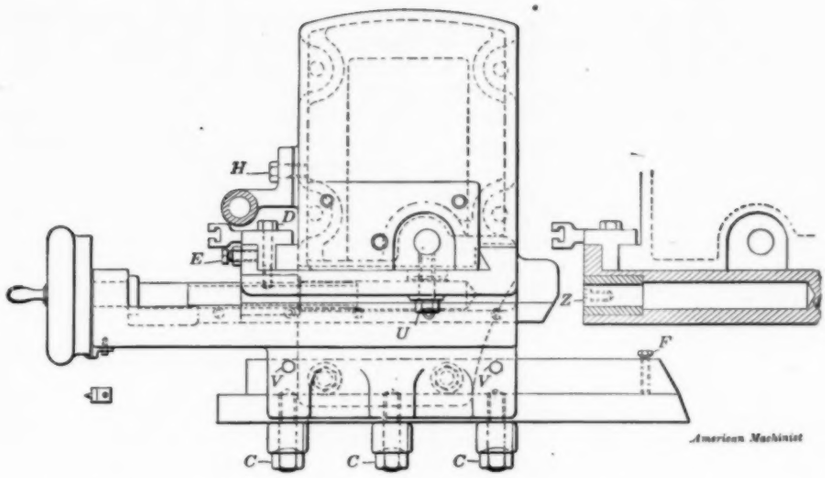


FIG. 3. DETAILS OF TOOL SLIDE OF RICHARDS' CRANK-PIN TURNING MACHINE

a Reeves variable-speed countershaft but the shop arrangements did not permit. The tool slides are on two vertical standards, the travel of each tool being eight inches and the highest position is 13 inches above the table top. A screw gives either hand or self-acting motion in a vertical direction while horizontal setting is effected by small handwheel and screw. The tools themselves are secured by three clamps.

Of 1½-inch by 1-inch section, the tools are backed by a steel bar two inches by one inch, right to the cutting point. This is shown in detail in Fig. 3. The small set screw at the end of the support is used to prevent trembling of the tool which would produce chatter marks on the pin.

RIGID TOOL SECURES ACCURACY

Apart from other advantages, the machine is thought to permit greater accuracy and finish of turning than is usual, and this is held to be due partly at least to the rigidity of the tool. The large spindle and the direct-belt drive also tend to the same end.

Fig. 3 indicates, too, the plate at the back of the tool slide which bears the trip pieces for the automatic knock-off to the feeds. These are self-acting in each direction and are obtained from a three-speed cone driven from the crankshaft, the lever-controlled gearbox raising the number of feeds to six. The arrangement will be fairly clear from the plan and corresponding elevation in Fig. 4, the remaining view here giving in addition a detail of the main driving pulley and the

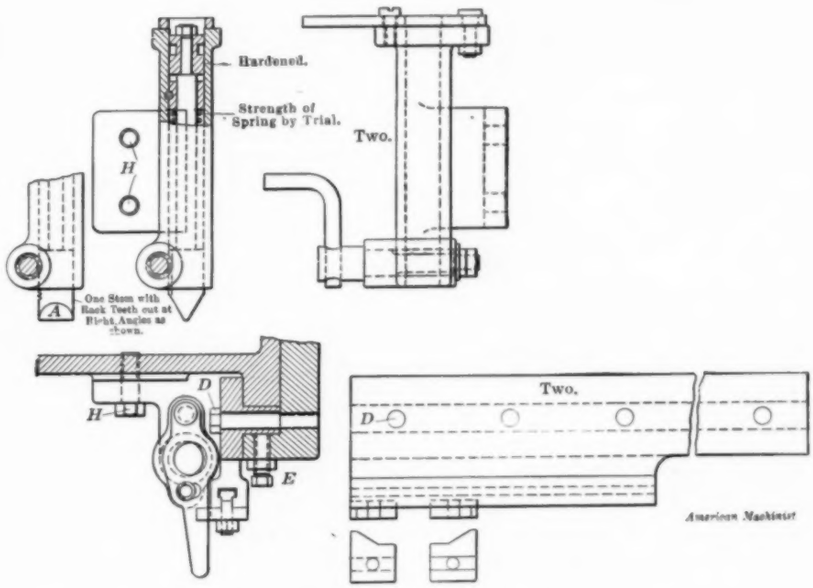


FIG. 5. DETAILS OF ADJUSTABLE TRIP PIECES AND SPRING PLUNGER OF KNOCKOFF DEVICE

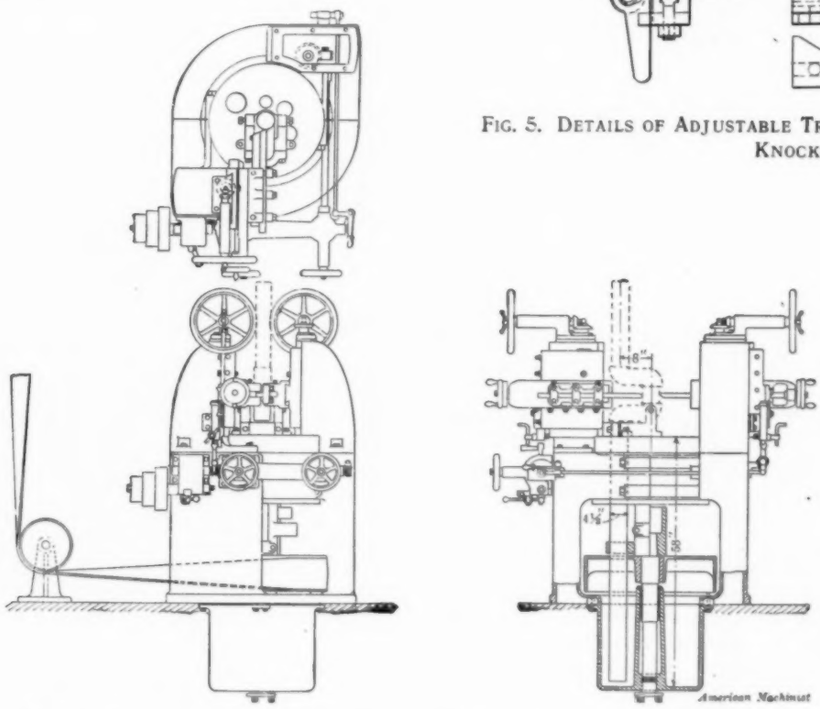


FIG. 4. PLAN AND ELEVATION OF RICHARDS' CRANK-PIN TURNING MACHINE

spindle bearing below. The hand vertical motion to the tools is, of course, obtained from the top hand- and bevel-wheels and vertical screws. For the self-acting motion, on the lower end of the screw is a wormwheel which runs loose. This is actuated by a worm on a horizontal shaft driven from the gearbox by means of bevels. Projecting from the boss of each handwheel on the top will be noted a small handle. This is on a rod which, passing through the horizontal spindle at the top of each column, bears at the opposite end a small bevel pinion gearing with another on a vertical rod. This by screw and nut action can lift sufficiently a friction plate which causes the wormwheel to drive the screw and this gives the self-acting motion to the tool.

AUTOMATIC KNOCKOFF DEVICE

Fig. 4 also shows the automatic knock-

off device. At the back of each tool slide are plates bearing T-slots in which adjustable trip pieces are secured. These are shown in detail in Fig. 5, where also will be seen the spring plunger arrangement controlled by the tripping pieces. The plunger is set by handle, pinion and rack, and of all these, and of the catch lever or latch which holds the plunger up when set, views are given in the same illustration. The lever system and its connection with the horizontal shaft can be gathered from Fig. 6 taken in conjunction with the top view of Fig. 4. The clutch-controlling lever is, of course, set by handle in front of it. When the clutches are out of action the swinging levers are vertical, as shown in the latter view and also, of course, in Fig. 6. A handle and clutch will disconnect one side of the machine from the other.

The net weight of this machine is about 4500 pounds and the floor space occupied is about six feet by five feet. The output is about one crank an hour on the average of the range. While little that is definite is avaliable as regards the accuracy of the product, the users do not seem to be able to detect errors by scribing-block methods of testing and as to roundness the pins are never found 5/10,000 inch out. The cranks as suggested are usually water-finished by tool and lapped, not ground.

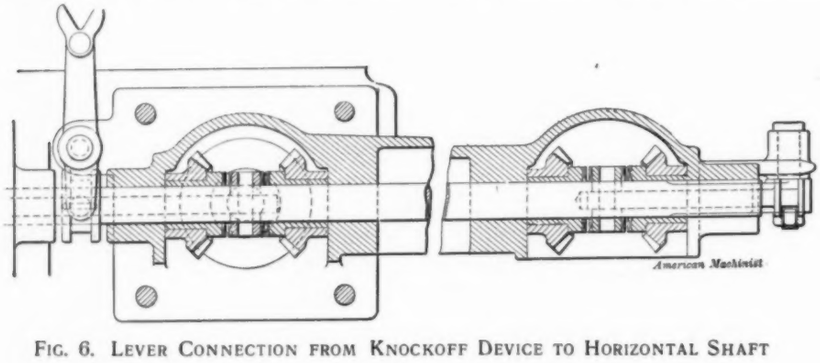


FIG. 6. LEVER CONNECTION FROM KNOCKOFF DEVICE TO HORIZONTAL SHAFT

Driving Drills and Boring Bars

BY S. H. COX*

The many discussions in regard to the best method of driving drills, the advantages and disadvantages of the tang, the flat and the key, seem to be bearing fruit in the shape of a desire to standardize a more effective driving method than the tang of time-honored memory.

There is a growing feeling among makers of drills that the adoption of a slot across the end of the drill spindle and corresponding driving ears on the drill at the large end of the taper shank, would be a decided advantage to all concerned.

From a manufacturing point of view the width of the slot would be determined by the diameter of the taper shank at its large end, so that the driving ears on the body of the drill could be easily formed by simply milling a flat on two sides of the drill, having the milling cutter come down to the large end of the taper. This would necessitate a slot of the same width across the end of the drilling spindle, as is being done on some of the heavier drilling machines at the present time.

A very similar plan has been followed in milling-machine practice, and also for driving boring bars in boring machines, but has been found open to the objection in some cases, that the remaining material on the spindle was not always sufficient to provide a satisfactory drive when large milling cutters or boring bars were used.

For this reason some makers of these machines advocate a width of slot from one-third to one-half the diameter of the large end of the taper, so as to leave considerably more material at the end of the driving spindle.

While this is comparatively easy from the standpoint of either the maker of milling cutters or of boring bars, it presents an entirely different problem to the maker of drills, as the cost of manufacture would be largely increased.

The accompanying letter, written in response to a query along this line, shows the position of the drillmaker very clearly, and it is hoped that others who have had worked along this line will give us the benefit of their experience.

"I have your letter with reference to our conversation in regard to the slotting of drill-press spindles to permit using the slot to supply an auxiliary drive at the lower and stronger end of the taper shank.

"I note that while many people appear to favor such as drive as this, the majority seem to feel that a slot as wide as the diameter of the hole in the spindle at this point leaves too little stock at the end of the spindle for driving the tools. They suggest a slot approximately ⅓ as wide as the outer edge of the hole, 'although ½ of this diameter would probably leave ample material.'"

"At first sight this would seem to be a good solution, but on going deeper in the matter we are brought face to face with the very serious and very practical problem of economically producing a tool with extensions to fit such a narrow slot. It is obvious that it would be extremely difficult to shape the lower end of any regular taper-shank drill so that it would mortise into such a slot. This is a very simple problem where the slot is the width of the diameter of the hole. All that is necessary in this case is to leave a portion of the tool at the lower end of the shank larger in diameter than the shank and mill away two sides of this collar so as to form opposite flat surfaces, the perpendicular distance between which would be equal to the diameter of the shank at this point. One-half of the difference between the round diameter of the collar and the round diameter of the shank would give the length of each of the lugs which would fit into the slots in the spindle to form the additional drive.

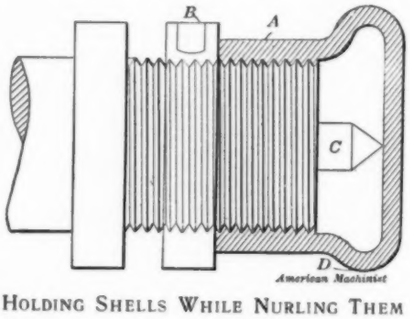
"In looking over the drill presses in our factory, I have failed to find a single one which, in my judgment, would not have plenty of stock at the lower end of the shank after the slot, such as I suggest, had been milled there. Possibly our machines may have unusually heavy spindles, but it seems to me the severe uses to which a drill press is put, in these days of high-speed tools, warrants the manufacturer giving the spindles plenty of strength at this point."

*Assistant general manager, the Cleveland Twist Drill Company.

Holding Shells while Nurling Them

BY W. LARSEN

We had a large number of threaded brass shells as shown in section at *A* to nurl at the part marked *D*. We first used a threaded mandrel with a nut *B*, thinking that they would not jam so hard that we could not slacken the nut *B* and release them. We found, however, that this was the case, so we took the nut *B* off and put in the center *C*, shown in dotted lines, for the shells to bear against. With this arrangement they were easily removed, with the hand alone, after being nurled.



HOLDING SHELLS WHILE NURLING THEM

Efficient Record and Route System—II*

By H. M. Norris †

Operation of the system and duties of those responsible for its manipulation. It has been in successful use for seven years.

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†Mechanical engineer, Cincinnati Bickford Tool Company.

The Manufacturing Schedule

In order to route the work expediently, it is necessary that the manager should keep before him for semi-monthly revision some such manufacturing schedule as is illustrated in Fig. 16. Each time he instructs the route clerk to issue an order for a new lot of heads he enters on the first unoccupied line the quantity, size, name and shop number, together with the number of hours the cost records show are usually consumed in building the machines of which they will form a part. The route clerk then inspects his unit cabinet to ascertain which supplementary units will be needed to erect the machines in the particular styles his sale cards indicate are in greatest demand, and submits a list of the same to the manager as explained under the caption of "Duties of the Route Clerk."

The next work of the manager in this connection is to sequence the lots. This he does by first arranging them in the order in which he would like them put through the shop. The governing factors in this are obviously sales—both actual and prospective—dates of deliveries already promised, and the relative stage of completion of the work. Then comes the task of resequencing the lots according to the floor space that will be available for assembling them. Here he is guided by the time records, together with the number of men in the respective gangs. All that now remains for him to do is to divide the lots into months, suffix a definite date to each, enter in the first of the three columns at the right the date the lot was sequenced and in the second the date of delivery then promised. The last column is for recording the date the lot was finished.

The Sequence List

Whenever the manager makes a change in the manufacturing schedule, the route clerk prepares for the foremen of each department what is termed the "Sequence List," Fig. 17. It is a compilation of the shop-order numbers, arranged in the sequence in which the work is to be handled, of all unfinished units that will form a part of the machines scheduled. The first step in this operation is to extract from their file the sequence cards for the head units, whose shop-order numbers are sequenced on the manufacturing schedule. The second is to renumber them in conformity with this. The third is to make such corrections in their entries, front and back, as the tags in the unit cabinet indicate are necessary. The fourth is to select from their file the progress cards whose shop-order numbers appear on the sequence cards. The fifth step is to change such of the sequence numbers on the progress cards as are effected by the revision of the manufacturing schedule, and the sixth is to set down on the sequence list intended for each department the shop-order numbers of such of the units listed on the reverse of the sequence card as the absence of dates or dashes in the column for that department denotes it will have to work upon in order to meet promised deliveries.

MANUFACTURING SOHEDULE.

DATE LAST NAMED	QUANT.	SIZE	NAME OF MACHINE	NO. OF ORD.	SEQ	HOURS TO BUILD	DATE WORK WAS SCHED.	PRQM.	FIN.
Sept. 7	12	6	Standard	9369	1	21000	5-1	9-2	9-6
" "	12	5	Universal	9667	2	14000	6-15	9-4	9-8
" 14	24	4	Standard	9860	3	17000	4-1	9-7	9-16
						52,000			
Oct. 1	12	6	Universal	8785	4	19000	6-1	10-1	10-2
" 4	24	4	Standard	9860	5	17000	4-1	10-28	10-6
" 25	24	4	Standard	9860	6	17000	4-5	10-18	
						53000			
Nov 1	12	6	Standard	9954	7	21000	6-1	1-1	
" 8	12	5	Improved	9611	8	13000	"	11-8	
" 18	24	4	Standard	9986	9	17000	4-15	11-19	
						51,000			
Dec. 1	12	5	Improved	9611	10	13000			
" 8	24	4	Standard	9986	11	17000			

American Machinist

FIG. 16. MANUFACTURING-SCHEDULE FORM

The Material Card

The material card, Fig. 18, is identical on either side, with the exception of the omission of the heading on the reverse. One is used for every dissimilar part for which the storekeeper has the ordering of the material. They are kept in his department, filed according to symbol. The first column is for entering the date the material was ordered, received, or assigned, the second column for entering the quantity of pieces ordered, the third for the quantity of pieces received, the fourth for the quantity of pieces in stock, the fifth for the quantity of pieces the shop-orders specify, the sixth for the date the material was actually delivered to the shop and the seventh for the shop-order numbers under which the material is to be issued. Arranged in this way, the card enables the storekeeper to answer any question that is likely to arise in regard to this part of his work.

The Work Tag

Whenever the storekeeper issues any material to the shop he fills out and attaches to one of the pieces the work tag shown in Fig. 19. Its usefulness is explained by the following "Notice to Workmen" printed on its reverse.

"Should this work be assigned to you, first count the pieces to see if the number agrees with the quantity specified.

"As the lot must not be broken under any circumstances, you will be held responsible for any shortage that may occur from the time you accept the work until such time as it shall be accepted by the next operator.

"The time of going off one job and onto the next must, in all cases, be identical. Time will consequently continue to be debited to your last order until you notify your foreman of the time it was finished.

"You will therefore do three things on being assigned each job.

1. Count the pieces before accepting the work.
2. Notify your foreman of the exact time that you commence the work.
3. Notify your foreman of the exact time that you complete the work."

Storeroom Receipts

The form upon which the storeroom receipts are communicated to the route clerk, and through him to the purchasing agent, is illustrated in Fig. 20. It requires no description further than to say that the entries are made by the storekeeper at the time the material is received, and that it is sent to the former daily.

Stores Withdrawal Order

The stores-withdrawal order, Fig. 21, is used by the foreman for obtaining from the storeroom material other than specified on the lot orders, that is, that required to replace defective material, bad workmanship, etc.

The Time Slip

The time slip, Fig. 22, is bound in pads of 100 each. It is used by the foremen for recording the time each of their workmen commence and finish an operation. They are sent daily to the cost clerk, who enters the time on the lot orders and then transcribes the elapsed time to his comparative time cards.

The Comparative Time Card

This form, Fig. 23, is used by the cost clerk for preserving a record of the time consumed in each operation on successive pieces of the same symbol. It is not only an aid in fixing limits for the premium plan, but exposes at once any excess of time that a workman consumes in his work. The column headed "Work" is for entering the number of hours that have been allowed for each operation, while that headed "S. U." is for entering the setting-up time. They are separated, as the work on two or more lots may be done without intermission, in which event the "Work" time only need be increased. The reverse of the card is divided into eight columns, headed: Order, Lot, 1, 2, 3, 4, 5, 6." The figures correspond with those on its face and are indicative of specific operations. The cards are filed according to symbol under the classification of the machine on which the pieces are used.

The Excessive Time Slip

The excessive time slip, Fig. 24, is used by the cost clerk for informing the foremen of the various departments of excessive time consumed by their men in performing the several operations assigned them. This is a most valuable adjunct to the system, as the workmen soon learn that all their time is inspected, and that to obtain more pay than another they must produce more work. It encourages the earnest workmen and weeds out the laggards.

General Comments

This is everything that need be said in explanation of the forms. Now, I will

SEQUENCE LIST

DEPARTMENT F DATE Oct. 15, 1910.

S	S.O.	S	S.O.	S	S.O.	S	S.O.	S	S.O.	S	S.O.
1	9011	4	8785	7	9120	13	8861	18	8369	25	9038
"	9058	"	9062	"	9144	"	9067	"	9103	"	9066
"	8906	"	9014	8	8612	"	8900	"	8942	"	8763
"	9059	"	8949	"	8955	"	9068	"	9080		
"	9100	"	9061	9	8715	"	9121	19	8667		
"	9060	"	9017	"	9090	"	9123	"	9145		
"	9099	"	9063	"	8717	"	9122	"	9146		
"	9110	"	8573	"	8714	14	8978	"	9147		

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FIG. 17. SEQUENCE-LIST FORM

MATERIAL CARD

Symbol 3A142 Bin A22

Spindle gear

Ord'd. or Rec'd.			Stock	Issued		
Date	O.	R.		Q	Date	S. O.
1-1			6			
1-9	30			24	1-20	9643
1-13		13	19			
1-18		17	36			
3-1	30		12	36		9860

FIG. 18. MATERIAL-CARD FORM—SIZE 3½x6 INCHES

WORK TAG

Lot No. 6877

Shop No. 9963

Symbol 3A27

Quantity 96

Drawing C1324

Name Head

Main Bracket

Material

Size

READ NOTICE ON REVERSE SIDE.

American Machinist

FIG. 19. WORK-TAG FORM—SIZE 2¾x5¼ INCHES

try to make clear the duties of those responsible for the manipulation of the system. Adjudged by the number of forms employed, one might think it an expensive system to operate. Such, however, is not the case, as one route clerk, one cost clerk and one storekeeper is all the force that is required by a concern employing 250 men. The production list, piece record, material list, standard-parts list, sales card and, in fact, all but a few of the forms, are as essential to the proper handling of the work as if the record and route features were omitted. The simplest things frequently require many words to explain. Many words are required to explain this system, but that it is both simple and effective has been abundantly shown by seven years of use.

Duties of the Route Clerk

As all shop orders are issued by the route clerk, it is with his duties that we will begin the description of the workings of the system. Suppose that he is instructed by the manager to issue an order for twelve No. 6 universal heads. He first inscribes a shop order, the number and date of which, together with what it calls for, he enters on a progress card, Fig. 6. [Refer to preceding article for forms from 1 to 15 inclusive.—Ed.] A copy of the former is sent to the drawing office, while the latter is filed with such other progress cards as he may have appertaining to shop orders that have advanced no further than this stage. The route clerk next issues a sales card, Fig. 7, a sequence card, Fig. 8, and an assembling card, Fig. 9, when he examines the unit cabinet, Fig. 10, to see if there are a sufficient number of supplementary units in course of manufacture with which to assemble this additional quantity of machines in the styles that past sales indicate may be wanted. After he has done this, he consults with the manager as to the kind and quantity of units that had best be ordered. These he handles in the same way as he did the heads. His next work is to stamp and hang on their respective hooks the tags for these new units.

This is as far as the route clerk can proceed with this work until such time as the drawing office sends him the necessary prints of the guide sheet, Fig. 3, the material list, Fig. 4, and the standard-parts list, Fig. 5, together with such new master route cards as it was necessary to make. Upon receipt of these, he issues the lot orders, Fig. 11, the information for which is derived from the material list, Fig. 4, and fills out the route card, Fig. 12, the data for which is had from the master cards heretofore mentioned. He next selects from his files the stores cards, Fig. 13, for such of the parts as the material list shows are purchased on the outside. Where a card indicates that the supply is sufficient, all he does is to enter on it the new shop-order number and quantity of pieces required to fill the order, when he checks the corresponding symbol on his material list and passes to the next item. But where a card shows that more parts will be needed, he enters also on the card the date and additional quantity to be ordered, and forthwith issues a requisition for this, using the form shown in Fig. 14. This done, he notes on the shop order the extremes of the lot-order number, and then enters on the progress-record card the letters denoting the departments through which the guide sheet indicates the work will pass. All that now remains to launch the order in the works is to send the requisitions to the purchasing agent, the guide sheets to the department foremen, and the lot orders, route cards, material list and standard-parts lists to the storekeeper, when the route clerk enters on his progress card the date each of these forms were distributed and files it and the material list according to their shop-order number.

STOREROOM RECEIPTS. Date Feb. 3, 1910

P.O. No.	DESCRIPTION	FROM WHOM RECEIVED	QUANTITY	SYMBOL
9652	Spindle forging	Morris & Buchman	50	3A123

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Fig. 20. Storeroom-receipts Form—Size 8x8¼ Inches

But the duties of the route clerk do not end here, for upon the receipt of each sales order, he has to make the necessary entries on the sales cards, Fig. 7, and the assembling card. Fig. 9, and bring down the proper tags in the unit cabinet, Fig. 10. Whenever he receives from the manager a revised manufacturing schedule, Fig. 16, he has to issue a new sequence list, Fig. 17, and supply the purchasing agent with a sequenced list of the symbols and purchase-order numbers of such material as is needed to complete the machines within the allotted time. This last information is compiled by referring to the manufacturing schedule, to see upon what dates the various lots of machines are to be shipped, the sequence list, to learn of what shop-order numbers each lot is comprised, the material list, to ascertain the symbols of such pieces as are purchased on the outside, and to the corresponding stores cards, to note what pieces are still lacking. He is also responsible for the issuance, at the proper time, of all shop orders for assembling the machines, as well as for those for repairs, new jigs, etc. Another of his duties in this connection is to enter on his master route cards, in the column denoting the department in which it is to be used, the shop-order number of each new jig for which he issues an order. Then there are the progress cards, Fig. 6, the sequence cards, Fig. 8, the assembling cards, Fig. 9, and the store-record cards, Fig. 13, that must be kept uptodate.

The first entails the entering thereon of the date the storekeeper and various department foremen return their guide sheets; the second, the transcribing of this information to the backs of the sequence cards; the third, the registering of the shop-order numbers, etc., on the face of the assembling card, and of the drill diameters, etc., on its reverse; and the fourth, the insertion on the store-record cards of the quantity of material received or issued each day by the storekeeper. Part of the latter information is derived from the form called storeroom receipts, Fig. 20, which passes through his hands *en route* from the storekeeper to the purchasing agent, while the remainder is furnished by the lot orders, Fig. 11, and the stores-withdrawal orders, Fig. 21, which likewise pass through him on their way from the storekeeper to the cost clerk. It is also the work of the route clerk to see that the date of inspection as reported on the reverse of the assembling card is transcribed to the sales card.

STORES WITHDRAWAL ORDER

Please supply the following from Stores, and debit to

SHOP No. 9260 LOT No. 3210 SYM. 3A142

1 - Spindle gear to replace bad casting

Date 10-15-10 Signed Wm Potter

American Machinist

Fig. 21. Stores-withdrawal Order Form —Size 4x5 Inches

By following this mode of procedure, many desirable things are accomplished. It enables the manager to ascertain at any time what work has progressed no further than the drawing office. It affords the drawing office an opportunity to incorporate in the new lot of machines all intended improvements. It insures the correction of such errors as were

made in the original routing, that the piece-record cards are kept uptodate, that no parts are ordered on the outside that the engineering department has decided to make in future, that no material will be ordered for parts that have been altered or discarded, that any new jigs that have been made will be brought into action, that orders will be issued in due season for such supplementary units as may appear expedient, that the unit cabinet and sales cards are kept uptodate, that all delays in getting work under way in the shop are traceable to the proper source, that the department foremen are informed what work they have ahead of them and just how each machine is to be assembled, and that a record will be preserved of the test of every machine, etc.

Duties of the Drawing Office

It has been stated that a copy of each shop order is sent to the drawing office. Here, if it has not already been done, the tracings for the guide sheet, Fig. 3, the material list, Fig. 4, and the standard-parts list, Fig. 5, are revised to incorporate any intended changes, and as many prints made from the one of the guide sheet as it shows are required to supply each department through which the work will pass, including that of the

TIME SLIP

Mr. Otto No. 98

STOPPED WORK ON

Lot Order No. 6877 at 3 o'ck

To Drill

The Work Called for on Lot Order No. 7280

Finished Unfinished A. J. K.

American Machinist

FIG. 22. TIME-SLIP FORM—SIZE 2½x3½ INCHES

route clerk. Of the tracings for the material list and standard-parts list two prints only are needed. The drawing office then enters on the piece-record cards, Fig. 2, the shop-order number on which such changes as were made first went into effect. It next makes out for each piece altered a new master sequence card, Fig. 8, and route card, Fig. 12, to show any variation in the sequence of operations, what jigs, if any, are available, and in what department and for what purpose each is to be used. The fifth and last duty of the drawing office in this connection is to fill in on the prints of the guide sheet, material list and standard-parts list, the shop-order number and quantity of units specified. These prints, with such new master route cards as it was necessary to make, are then sent to the route clerk.

Duties of the Storekeeper

When the material list, Fig. 4, lot orders, Fig. 11, route cards, Fig. 12, and standard-parts lists, Fig. 5, reach the storekeeper, his first duty is to issue a foundry order for the cast-iron parts. This is done in conjunction with entering on his material cards, Fig. 18, the shop-order number and quantity of each symbol the material list indicates will be required to fill the order. Whenever a material card shows a sufficient quantity of material on hand to satisfy this additional order, he places a check mark opposite the symbol on the material list and passes to the following item. But whenever a material card denotes that there is not a sufficient quantity on hand to fill both this and such previous orders as he may have remaining in his files, he notes on both the foundry order and the material card the additional quantity he thinks it wise to have made. This is left to his judgment as no one else in the works is in position to keep as well informed as to the excess of material of various symbols it is expedient to carry for the purpose of furnishing repairs and replacing defective castings or bad workmanship.

On the completion of this operation, the storekeeper sends the order to the foundry and then issues work tags, Fig. 19, for all pieces, other than those marked with an "S," that the material list indicates are to be made from bar stock. The information for filling out all but the top line is furnished by the material list. This he obtains from the lot orders, and while doing so he lays aside those for such parts as are made in the screw-machine department. The storekeeper next checks off on his material list the symbols corresponding with these lot orders, enters on their reverse the kind, size and estimated weight of the material required by each, and returns them to the route clerk. The work tags and route cards for these pieces are then sent to the foremen of the screw-machine department, while the remaining work tags are sent to the cutting-off department, but unaccompanied by their route cards; nor does he at this time relinquish his custody of the corresponding lot orders.

This done, the storekeeper files the material list according to its shop-order number and then turns his attention to the filing of the remaining lot orders and route cards. The former he files according to their symbol, regardless of the separation that may ensue, while he files the latter in either one of two ways. If their shop-order number appears on the sequence list, Fig. 17, he files them according to the sequence in which it shows the work is to be put through the plant; otherwise he files them according to the sequence of their shop-order number;

7

COMPARATIVE TIME CARD.

Feed clutch

SYMBOL 3A607 LIMIT ON 24 PIECES

	OPERATIONS	WORK	S. U.	MACH.
1	Bore and Turn	8¾	1	
2	Finish Turn + Counterbore	15		
3	Mill	7		
4				
5				
6				

Remarks:

E 282014-T THE GLOBE-WERNICKE Co. CINT., N.Y. & CHI.

American Machinist

FIG. 23. COMPARATIVE TIME-CARD FORM—SIZE 4x6 INCHES

EXCESSIVE TIME SLIP

MR. Wm Peters

YOUR ATTENTION IS CALLED TO THE FOLLOWING WORK

John Brown SPENT 17 HRS.

IN milling

24 PCS. MARKED 3A64 S. No. 9783

AS COMPARED TO OUR PREVIOUS RECORDS OF

13¼ HOURS 14 HOURS 13 HOURS

W. B.

TIME CLERK

American Machinist

FIG. 24. EXCESSIVE TIME-SLIP FORM—SIZE 3¼x4½ INCHES

i.e., places them in numerical order with the route cards for such other work as also is awaiting assignment.

This disposes of all the forms other than the standard-parts list, which he handles in the same way as he did the material list when ordering the castings, the only difference being that for this

work he issues requisitions instead of a foundry order, for such additional parts as the material cards indicate should be procured. These requisitions are of ordinary form and are sent directly to the purchasing agent. At the completion of this operation the standard-parts lists are filed according to their shop-order number.

Let us now see in what position the storekeeper finds himself in regard to the future handling of the material. The lot orders, by being filed according to their symbols, enable him to ascertain instantly for what shop-order numbers material is arriving, facilitate finding the particular lot order upon which he wishes to enter the material, and bring together all lot orders of like symbol. The advantage of this feature for such work as is performed with special fixtures is obvious. The route cards, by being filed in the two ways mentioned, enable him to keep the foundry informed as to the relative preference it should give the various orders, make it easy for him to ascertain at any time just what material is still needed to fill the order for any particular unit, and furnish the means for determining which of several lot orders of the same symbol should be filled first. The material list and standard-parts list, by being filed according to their shop-order numbers enable him to learn the status of any unit as a whole; that is, what material is on hand, what is still to come, and what has been issued to the shop. This last information is recorded by drawing a line through the symbol at the time each set of pieces is issued.

The remaining duties of the storekeeper are to see that the route cards for each shop-order number are re-sequenced, as regards their relative position in the files, whenever a change is made in the sequence list; that a daily report is made to the route clerk of all storeroom receipts, Fig. 20; that all material received or issued is entered on the material cards; that, as soon as the last of the material for any particular lot order shall have been received, its route card is sent to the foreman of the department in which the first operation is to be performed; that, whenever he has two or more lot orders of the same symbol, the material for all is delivered to the shop at the time that for either of them is requested; that each lot of material is delivered to the particular department listed to perform the initial operation, and that no material is permitted to enter the shop without a work tag, entering its weight, etc., on the lot order, drawing a line through its symbol on the material list or standard-parts list, and sending its lot order to the route clerk.

This disposition of the forms continues until the last of the material shall have been issued to the shop, when the storekeeper dates his material list and returns it to the route clerk.

Magnetic Trip and Safety Device

By Adolf Schlopflin

Details and action of a magnetic safety device applied to presses with highly satisfactory results bv a German firm.

To run a stamping press without catching one's fingers occasionally, is a difficult problem. In spite of all precautions and rules, the number of such disasters is not small. This is partly so because the safety regulations conflict with the productivity of the workman or are circumvented by him. Two well known forms of trip with their safety arrangements will first be discussed.

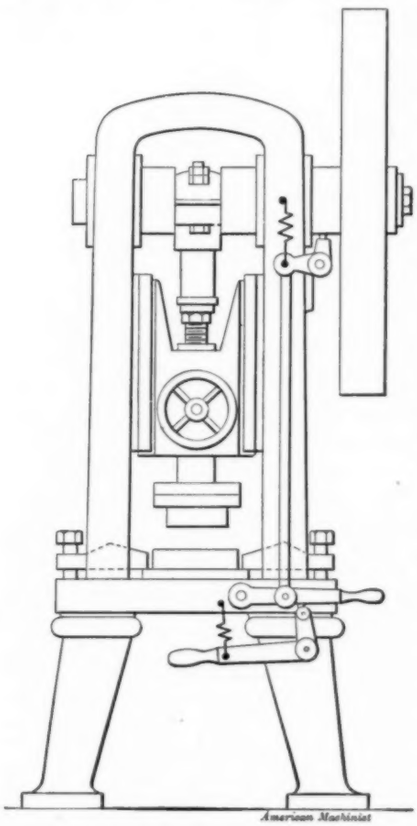


FIG. 1. TRIP BY HAND LEVER

The clutch is actuated by a foot lever. The only safety devices that we need consider in this case are those where, when the ram descends, a lever or pusher forces the hands out of harm's way.

The clutch is thrown on by a hand lever. The safety device in this case is a second lever connected with the first in such manner that it must be operated simultaneously, so that the press is tripped only when both hands are on the levers and out of harm's way.

The first method is impracticable because the movement of the lever or pusher is a multiple of the ram stroke. The stroke of eccentric presses has a velocity of 3 to 6 inches per second. Since the hands must be thrust aside during the first part of the stroke, the lever for that purpose will have a velocity of at least 20 to 40 inches per second, which means dealing a pretty hard blow to the hands. Beside this disadvantage, most such fixtures must be removed for mounting the press tools.

The second method is much more convenient, requiring both hands to be on the levers when the ram descends. Fig. 1 shows this form. If we assume, however, that it eliminates all danger, we have failed to reckon upon the press operator, for he soon learns to take care of the safety lever by loosening the spring or attaching a weight. Furthermore, the two levers do not improve the output and after they are introduced the workmen demand a higher piece rate.

A MAGNETIC TRIP

The magnetic trip, Fig. 2, acts on the same principle as the second method, with the difference that instead of the two levers, the operator pushes two electric buttons, thus closing the circuit of an

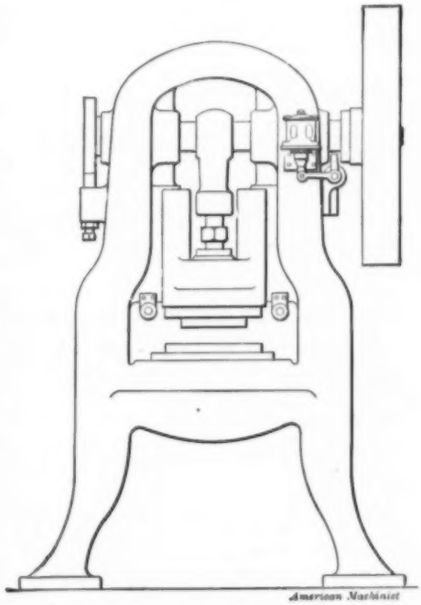


FIG. 2. MAGNETIC DOG-TRIP KEY

electromagnet. This magnet pulls a core, or armature, which raises a lever connected with the clutch pawl. This trips the press. After the current is cut off the core falls of its own weight, aided by a spring to overcome hysteresis and friction. Fig. 2 shows the arrangement of such a magnet which is made by electrical firms under the name "brake magnet," and owes its name to crane service wherein when the motor stops the magnet causes the brake to act.

To avoid tiring single fingers, the buttons are made extra large. The workman

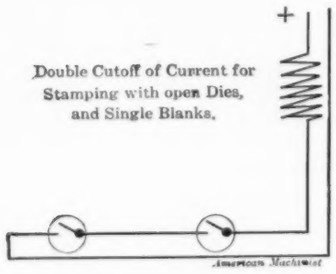


FIG. 3. DIAGRAM WITH DOUBLE CUTOFF

cannot destroy the efficacy of his protection by cutting off the current, since in that case the trip would not operate.

The advantage of this magnetic release consists in the easy pressure required on the buttons, whereas working two levers necessitates an adaptation of the entire body to the task, and in large presses needs a considerable force to overcome the springs. By this method the workman directs the magnet, which operates the clutch. It has, therefore, been possible to attain, with the large presses in

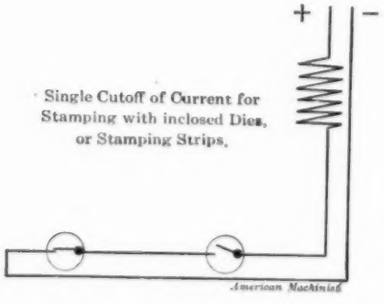


FIG. 4. DIAGRAM WITH SINGLE CUTOFF

the stamping department in the Felten-Guilleaune-Lahmeyerwerke, Frankfurt, a. M.,Germany, a 20 per cent. increase of output. The firm has successfully used the magnetic trip for two years.

ON STRIP STAMPING

In stamping strips of sheet metal or with inclosed press tools, it would be a superfluous precaution to require tripping with both hands, because in this work the hand guiding the strips is not in danger. For this purpose one of the press buttons is provided with a lock which can be unfastened by the foreman in case there is dangerous work to be done. In this work one hand rests quietly on the button and only the thumb need be moved.

Fig. 3 is a diagram of electric connections with double cutoff of the current, appropriate to cases where the blanks have to be put in place by hand. In Fig. 4 there is only a single cutoff, and the circuit must be closed at only one point, that is to say for work with inclosed tools or stamping out strips. Fig. 5 shows a switch diagram for a three-phase magnet. Since the magnet will work even with two phases, interruption of at least two is necessary to prevent its action. Hence there is used a double-contact button shown at *a a* in Fig. 5, the link between the two parts being marked *b*. The contact *c* is either applied with the other hand or closed with a lock.

When installing the magnetic trip on existing presses, the requisite force and stroke of the magnet is experimentally

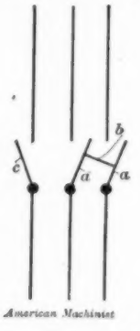


FIG. 5. DIAGRAM FOR THREE-PHASE LINE

determined by attaching weights. The voltage and form of current are data also necessary in selecting the magnet.

One may properly seek to get along with a magnet having a normal stroke of 1.5 to 2.5 inches, and by the use of levers this is not difficult.

Presses with axial trip dogs naturally need stronger magnets than those with pivoted pawls for which generally the smallest type with 8 to 10 kilograms pull suffices, while axial dogs require 25 kilograms and over.

Bottoming Taps—Affiliated Interests

BY JOHN R. GODFREY

One of the shop customs which seems to cling very tenaciously in some places is the making and buying of machinists' hand taps in sets of three. Every apprentice boy soon learns to know the taper, plug and bottoming tap, but it is probably perfectly safe to say that in very few cases does he find the necessity or the opportunity of using the latter.

It is always cheaper to tap through holes where possible, and there are few cases where it becomes necessary to have the thread go any nearer the bottom of the hole than can be done with a plug tap. In fact, there are very few places where even the plug taps need to be run dangerously close to the bottom of the drilled hole.

And yet the bottoming tap continues to be made as a part of every set of hand taps, and we continue buying them because our grandfathers did.

As a matter of fact, in many cases, they are ground back and used as plug taps, but this could be done much more economically and better in every way by the maker than by the user. Perhaps some of the makers and users (if there are any) can tell us why they should continue to be made.

AFFILIATED INTERESTS

While there may be advantages in the affiliation of various interests, such as a valve-making concern becoming interested in a turret-machine shop, it also has its drawbacks.

In such an imaginary case as this, the superintendent or works manager of the valve company is almost compelled to buy the machines built by the concern in which his company is interested, whether they are the best for his particular purpose or not. It would be difficult to explain to a board of directors, whose usual duty is to ask the works manager why in blazes he hasn't made more money during the year, and whose only knowledge of the value of the machine in question would be that it helps dividends in the affiliated concerns, why he bought another make of machine.

Many salesmen have been told that there was no chance to sell goods in a certain shop because they were affiliated with some concerns building a line similar to that which the salesmen represented. And the worst of it all is, that men who would be highly indignant if you intimated that they were lacking in business principles, seem to feel perfectly justified in using the machines which they know are not the most efficient, because they happen to be made by someone who is affiliated with them in a business way.

It is one of the first principles of business management to use the most efficient machines and methods for the conditions which are presented. Machines should be bought with this one object in view, and we should entirely forget who makes the machine.

Buying machinery simply because the manufacturers happen to be affiliated with us in some business way is simply another form of the bad habit of swapping machine tools. And we all know that many a shop is losing money every day because it refuses to buy machines of concerns who will not buy their particular product in return.

Problems in Shop Trigonometry

By George D. Hayden

Some everyday problems in setting work for milling operations.

Effect of viewpoint upon apparent size of an angle and necessity of working from its true size.

There are problems in angles that sometimes come up in drawing room and shop practice, that might almost be called solid trigonometry. One may be quite familiar with the formulas for solving right triangles and yet be at loss as to just how to proceed when one of those difficult problems arises.

In giving the few following illustrations, I hope to bring out the difficult point, so that, should the occasion require, one will have a better understanding how to proceed to arrive at the correct result.

To start with; I find that in the greater part of my trigonometrical work, I use the three following formulas in right triangles nearly altogether. When I have occasion to use formulas in oblique triangles, I usually refer to my text book, for safety.

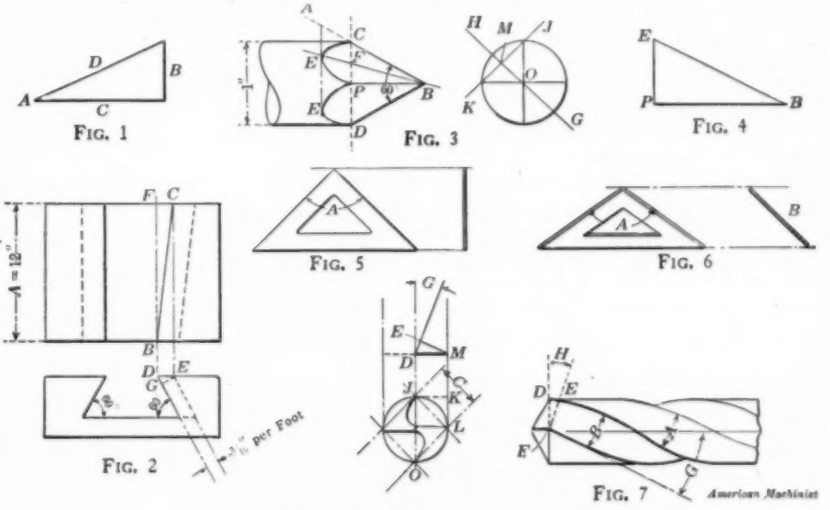
Referring to Fig. 1:

First, $sin.\ A = \frac{B}{D}$; by transposing we have $B = sin.\ A \times D$; and again, $D = \frac{B}{sin.\ A}$; 2d, $cos.\ A = \frac{C}{D}$; by transposing we have $C = cos.\ A \times D$; and again, $D = \frac{C}{cos.\ A}$; 3d, $tan.\ A = \frac{B}{C}$; by transposing we have $B = tan.\ A \times C$; and again, $C = \frac{B}{tan.\ A}$.

These formulas, for the draftsman, the machinist or toolmaker, ought to be well mastered and understood. The other formulas for right triangles are derived from these and, therefore are not so important nor necessary to comit to memory as are these three.

Take for the first example, the much used angled, taper gib, to bring out the point in question. Referring to Fig. 2, we have a dovetail with one side tapered for gib. Usually, the angle of taper is made some fractional part of an inch per foot, at right angles to dovetail; in this case we will say taper 3/16 inch per foot. Now, the point is, when it comes to planing or milling this dovetail, the work is set around so as to come straight; but it should not be set around 3/16 inch per foot, as I have more than once known it to be done, for the taper is at right angles to dovetail, and not parallel to base. The amount it should be set around is found by laying off $GE = 3/16$ inch and, in the top view, lay off distance $A = 12$ inches; locate points B and C, which are projected from D and E. The distance FC is the taper required to set work over so that, when milled, the dovetail will taper the expected amount.

Now, as distance FC is the same as DE, and DE being the long side of triangle DEG; we have, according to the third part of the second formula, $DE = 3/16 \div cos.$ of 30 degrees. This we find to be 0.216; that is, FC is 0.216 inch when taper of gib is 3/16 inch per foot and angle of dovetail is 60 degrees. Therefore, we put in a gib tapering 0.216 inch per foot, to set work over the required amount.



PROBLEMS IN SHOP TRIGONOMETRY

SECOND EXAMPLE. SQUARE CENTER

We wish to make a square center with included angle between the sharp edges 60 degrees. It will be the same as an ordinary 60-degree round center with 4 sides milled as shown in Fig. 3.

If we take an ordinary 60-degree center and set it up 30 degrees on machine, line AB will be horizontal. But, as points E are further from end B than the points C and D, the intersection of the angle and outside diameter; it shows that the work will have to be set back to a less angle than angle of center. The required angle is calculated thus: The lines FB and GH are drawn through the center of flats; draw line JK, intersecting GH at M. M is identical with F. We now have a right triangle, Fig. 4, which we will separate for convenience, where FB is the long side, BP the side adjacent, and MO or FP the short side. The point P, of course, lies on the axis of the work.

To find the length of BP, we will refer back a little. The work, we see, is 1 inch diameter, so, in the triangle BCP (P on axis), we have $CP = \frac{1}{2}$ inch, with small angle of 30 degrees. Then, according to the third part of the third formula, $BP = \frac{1}{2} \div$ tan. 30 degrees, which we find to be 0.866 inch.

To find FP, which is the same as MO, we have triangle JMO; $OJ = \frac{1}{2}$ inch and, by inspection, the angle is 45 degrees. We now apply the second part of the second formula: $MO = cos.$ 45 degrees $\times \frac{1}{2}$; this equals 0.3535 inch. Applying these results to Fig. 4: $BP = 0.866$ and $FP = 0.3535$; therefore, the tangent of angle B is equal to, according to the first part of the third formula, $0.3535 \div 0.866$, or 0.4082. Consulting our text book, we find this to be the tangent of 22 degrees 12 minutes, which is the angle to which to set up our work on milling machine to make a 60 degrees square center.

THIRD EXAMPLE. THE TWIST DRILL

This problem is much more difficult, as it involves projection of angles; for instance, take an ordinary 45-degree drafting triangle and set it up as shown in Fig. 5; angle A, of course, is 90 degrees. Now, throw back the end view, as shown at B, Fig. 6, and project from it the front view. The actual value of angle A has not changed; it is still 90 degrees but, projected the way it is, it does grow larger and, should we drop the end view until it reaches the horizontal position, the larger angle A will grow, until it reaches the limit of 180 degrees, or a straight line. This principle is involved in the following example, Fig. 7.

Take the case of a twist drill, where we may want the width of land A and space B alike, across in an air line at the point of drill. When A and B are to be

alike, we can measure A with micrometer calipers and know when the work is correct; also, when A and B are alike, we know that C is one side of a square and its length is easily calculated from the diameter of drill.

To find B, one might naturally work to solve the right triangle DEF, using C for side FD, and angle G, the cutting angle of the drill, for value of angle H. This, however, is not correct, because angle H is not the same as angle G. If the line DF were at right angles to JO, as is line JK, the angles would be alike; however, the fact that line DF, which is the same as line JL, is not at right angles with center line JO, is what varies the angle from G. Therefore, we calculate the distance DE from projecting JK to DM, using the angle G and half diameter of drill JK. Now, having distances DE and JL, of the triangle DEF, we are able to figure the distance EF, which is the width of space that we desire to find. We can also find the difference between angle H and angle G, and the latter will be found to be the smaller.

Recording Indicator for Punching*

By Gardner C. Anthony†

Use of an ordinance indicator to record stresses in punching boiler plates. The device serves admirably to determine data relative to maximum stress in punching, effect of punch and die clearance on this stress, advantages of shearing punches and effect of time on rate of flow of metal being punched.

*Paper presented to the American Society of Mechanical Engineers.

†Dean, Engineering School, Tufts College.

The design of this device was assigned as the subject for a mechanical engineering thesis at Tufts College, in the endeavor to determine such values as the maximum pressures for which punching machines should be designed, the point of maximum stress in the punching of plates, the advantages to be derived from the use of shearing punches, the effect of increased clearance between punch and die on the maximum stress and the effect of time on the flow of metal in punching.

The apparatus was designed to enable indicator diagrams to be taken under the conditions of actual shop practice by applying the mechanism to punching machinery now in use. It was first used in May, 1909, at the New England Iron Works, South Boston, where it was applied to a Bisbee-Endicott lever-type punch, for which it was designed. Tests were made on plates of ¼ inch, 7/16 inch and ½ inch thickness, with punches of ½ inch, ⅝ inch and ¾ inch diameter.

Only such tests were made at that time as were deemed necessary to demonstrate the efficiency of the apparatus, since before applying it to a series of tests it was thought desirable to compare the indicator diagrams already taken with those which might be obtained from its application to a testing machine, as illustrated in Fig. 1. This was done in June, 1910, when it was applied to a 60,000-pound Olsen testing machine. The results demonstrated the desirability of continuing the experiments on this machine, since there was but a slight variation in the cards, due to the increased time of punching, while a much greater range of speeds was possible.

The number of tests now made are insufficient for conclusive evidence concerning the problems relating to shearing stresses, but it was thought desirable to present this application of an indicator as a useful addition to recording devices for testing machines, and to give some results of tests already made for the purpose of stimulating experimental work in this direction.

The principle employed in the design of the pressure-recording mechanism was that of the Emery testing machine, save that the hydraulic chamber communicates directly with an ordnance indicator, as in Fig. 3, which shows a cross-section of the compression cylinder with the indicator attached and the motion mechanism bolted to the crosshead of a punching machine. The die N is clamped to a piston P, which rests on a thin diaphragm D inclosing a small volume of oil, the pressure of which is recorded by the indicator. The piston has an area of 50 square inches and is guided by two annular steel disks fixed between rings E and F and K and L. These serve to centralize the piston and to eliminate all frictional losses due to surface contact. The die N is held in place by an interrupted screw S, by means of which the die can be removed quickly and the burs, or punchings, removed from the space below. The diaphragm is made of sheet brass 0.007 inch thick and fitted to the grooved space G, at which place the pres-

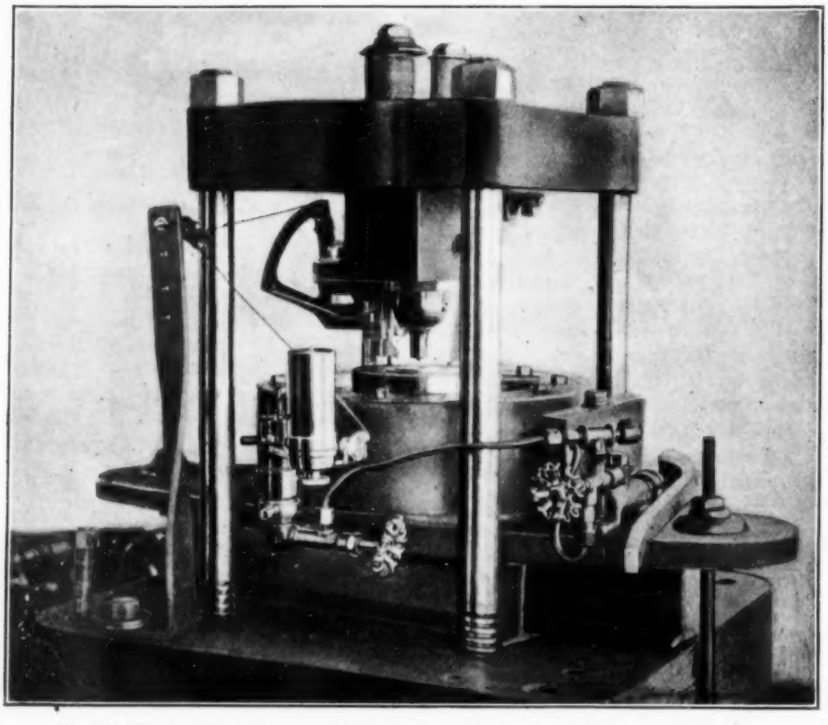


FIG. 1. PRESSURE-RECORDING APPARATUS APPLIED TO TESTING MACHINE

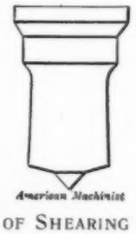


FIG. 2. TYPE OF SHEARING PUNCH USED

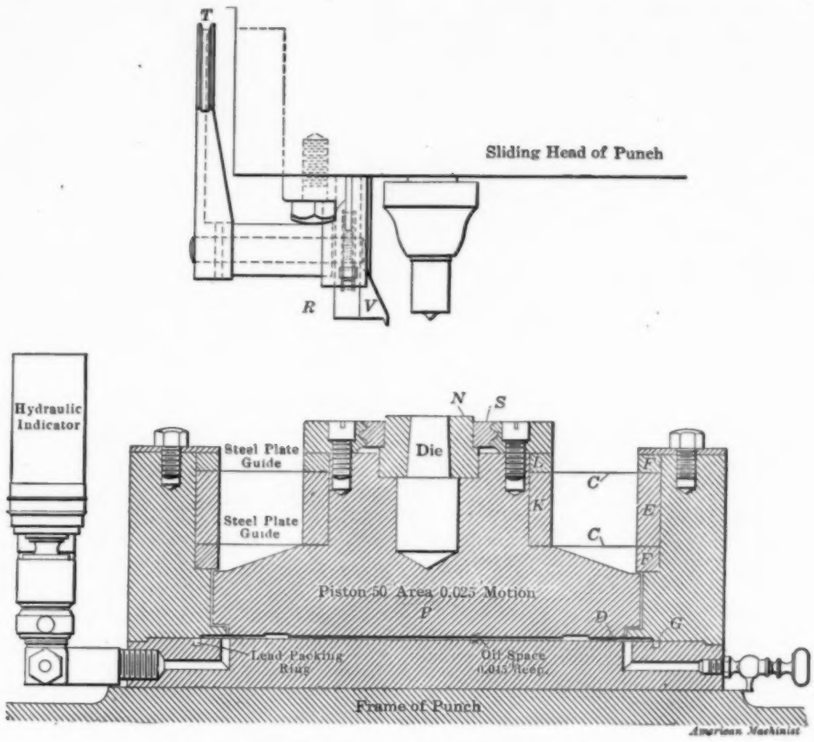


FIG. 3. SECTION THROUGH COMPRESSION CYLINDER

sure chamber is made tight by a lead packing ring. An air valve and an indicator pipe communicate with this space. The recess on the lower face of the piston serves to make the diaphragm taut by being forced into place when first under pressure, and also permanently to center the piston. The piston and die have a possible motion of 0.025 inch, the limits being determined by the lower ring *F* and the inner flange at the bottom of the cylinder. Only a small part of this motion is necessary, since the ratio of pressure piston to indicator piston is 2000 to 1.

Fig. 4 illustrates an oil tank, pump, gage and pipe connections to enable the operator to insure a supply of oil under slight pressure before each operation and to provide for a slight loss through leakage by the indicator piston. The general arrangement of these fixtures is more clearly shown in Fig. 1, which illustrates the mechanism applied to the Olsen testing machine.

The motion mechanism for indicating the travel of the punch in the plate is attached to the crosshead of the testing machine or punching machine. It consists of an arc *T* and a wheel *R* (Fig. 4), operated by a metallic band connection be-

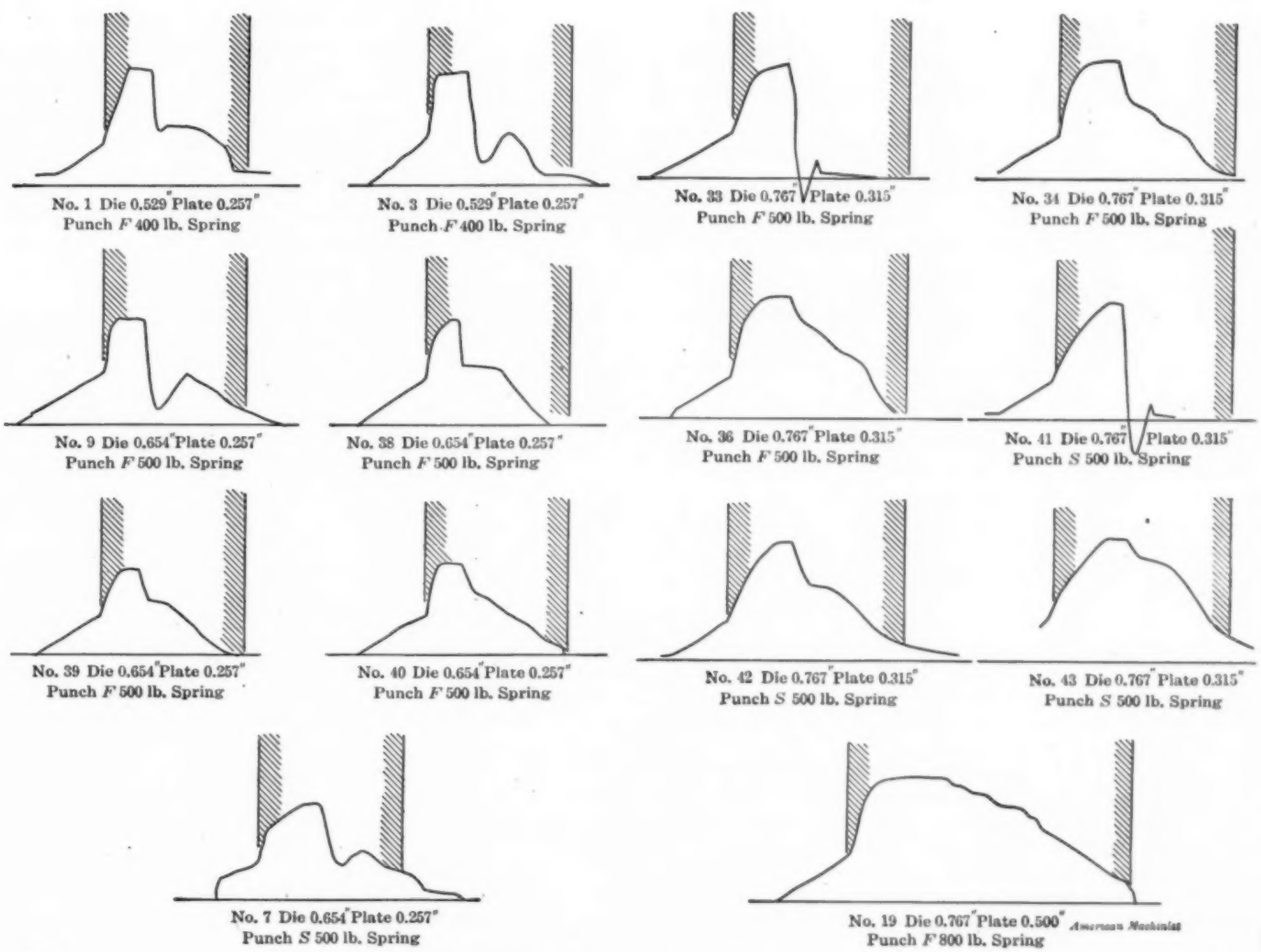

No. 1 Die 0.529" Plate 0.257"
Punch F 400 lb. Spring
No. 3 Die 0.529" Plate 0.257"
Punch F 400 lb. Spring
No. 33 Die 0.767" Plate 0.315"
Punch F 500 lb. Spring
No. 34 Die 0.767" Plate 0.315"
Punch F 500 lb. Spring
No. 9 Die 0.654" Plate 0.257"
Punch F 500 lb. Spring
No. 38 Die 0.654" Plate 0.257"
Punch F 500 lb. Spring
No. 36 Die 0.767" Plate 0.315"
Punch F 500 lb. Spring
No. 41 Die 0.767" Plate 0.315"
Punch S 500 lb. Spring
No. 39 Die 0.654" Plate 0.257"
Punch F 500 lb. Spring
No. 40 Die 0.654" Plate 0.257"
Punch F 500 lb. Spring
No. 42 Die 0.767" Plate 0.315"
Punch S 500 lb. Spring
No. 43 Die 0.767" Plate 0.315"
Punch S 500 lb. Spring
No. 7 Die 0.654" Plate 0.257"
Punch S 500 lb. Spring
No. 19 Die 0.767" Plate 0.500"
Punch F 800 lb. Spring
American Machinist

FIG. 5. SPECIMEN DIAGRAMS FROM RECORDER FIG. 6.

tween the latter and the finger *V*, which is set in motion by contact with the plate to be punched. The indicator motion ratio is 5.5 to 1.

Special punches and dies were made for these tests, both flat and shearing punches being used. The latter were of the type illustrated by Fig. 2. No lubricant was used in these tests.

Characteristic Cards

Before taking a card, a datum line of zero pressure was drawn, after which the oil pump was used to obtain a slight pressure in the compression chamber before operating the punch. The series of diagrams shown in Figs. 5 and 6 were reproduced from indicator cards, verticals being drawn in correct relation to the diagrams to indicate the thickness of the plate at the enlarged scale produced by the motion mechanism. Flat punches are designated by *F* and shearing punches by *S*. Cards numbered less than 20 were taken on the Bisbee-Endicott punching machine operated under normal conditions. Cards numbered more than 20 were taken on the Olsen testing machine. When punching on the testing machine the stresses were frequently checked by reading the pressures from the scales of the machine.

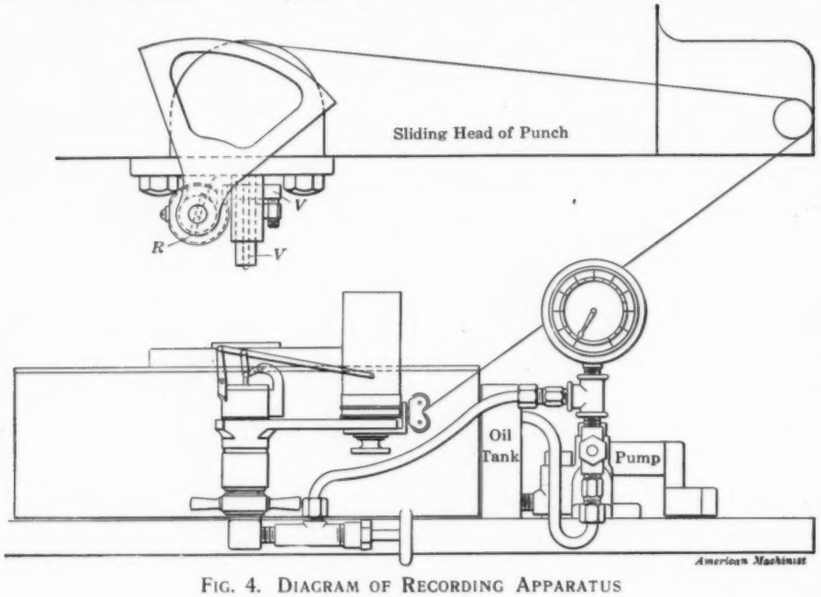


Fig. 4. Diagram of Recording Apparatus

No. 3 is a characteristic card taken while punching a ¼-inch mild-steel plate with a ½-inch flat punch on the Bisbee-Endicott machine. The inclined line at the left indicates the pressure required to force the point of the punch into the plate, which in this case is about 1000 pounds. The maximum stress is obtained at about 6 per cent. of the thickness of the plate and is 23,000 pounds. This would make the shearing stress about 57,000 pounds per square inch. The continuance of the pressure to the right of the plate indicates the force necessary to push the bur through the die. Previous to taking card No. 3, the punching machine was operated by hand to test the adjustment of the apparatus and card No. 1 was taken. In this case the pressure under the diaphragm was raised to about 50 pounds before starting to punch, which will account for the abrupt termination of both ends of the card. The maximum stress is the same as that indicated in No. 3, but occurs at about 15 per cent. of the thickness of the plate, due to the increase in the time of the operation.

The effect on the maximum stress caused by an increase in the time for the passage of the punch through the plate is shown by cards Nos. 9, 38, 39 and 40, in which the range is from about ¼ second to 8¼ minutes. There is no apparent cause for the rise in the maximum stress of No. 40 and it is possible that the error is in No. 39.

Card No. 7 shows the effect of using a shearing punch under conditions identical with No. 9.

No.	Time, Seconds.	Maximum Stress, Pounds per Square Inch.	Percentage of Thickness of Plate at Which Maximum Stress Occurs.
9	¼	31,000	10
38	80	30,000	18
39	310	25,500	18
40	495	26,000	13

TABLE 1. EFFECT OF TIME ON MAXIMUM STRESS.

The effect on the stress produced by increasing the clearance between the die and punch is shown by the accompanying table and cards Nos. 33 to 43. The tests were made on the Olsen machine, using a die of diameter 0.767 inch and punching a plate 0.315 inch thick.

No. 19 is a card taken while punching a ½-inch plate of mild steel with a ¾-inch flat punch on the Bisbee-Endicott machine. This illustrates the effect of a small clearance on the force required to remove the bur, as the difference in diameters of punch and die was but 0.017 inch.

No.	Type of Punch.	Diameter of Punch, Inch.	Clearance,* Inch.	Maximum Stress, Pounds per Square Inch.
33	F	0.702	0.065	32,000
34	F	0.738	0.029	33,000
36	F	0.750	0.017	34,500
41	S	0.702	0.065	32,500
42	S	0.738	0.029	34,000
43	S	0.750	0.017	34,000

*Difference in diameters.

TABLE 2. EFFECT OF CLEARANCE ON MAXIMUM STRESS.

The Education of the Railroad Apprentice*

By Richard Keefe

The education of the apprentice has many sides, some of which are visible, others only felt or shown upon occasions. I remember one morning going into the shop from the classroom, a few minutes after nine, and the foreman put me on a job immediately with a first-class mechanic, whose first salute to me was, "The railroad is losing money on you fellows."

Every mechanic expects the apprentice to "hop" to his music, every apprentice knows the mechanic will "kick" to his tune, for the mechanic has no time for the "greeny." The only man who understands apprentice language is the "angel" (which is slang for shop instructor), but it is no miss to call him such, for without him the greeny would never grow, but would be at a standstill half his time; sometimes we wish the angel were twins, even triplets would no more than meet the demand. Of course, the mechanic is not greatly to blame, as under the present system "Time is money." If "Teddy" was apprenticed under the piecework plan, after a week he would inform the public that it was "Fagan's school;" if they should ask questions he would refer them to Oliver Twist. Piecework is not a good school for the apprentice to become an expert workman in, he catches the spirit of rush and hustle that is all around about him, and soon is satisfied if his work just does, without any desire to improve it; he may make more pay and often does if work is plenty, but he loses sight of the main object of work, which is perfection. There will be but few inventions from the coming crop of mechanics, and piecework is responsible for this; it is like applying steam power to human brains, and steam won't drive brains.

The rate paid a first-year apprentice is out of proportion to his needs; even a first-yearer must eat like a man and dress like a man in order to work like a man; he looks like a man and feels like a man until he puts his hand into his pocket.

*Read before conference of New York Central apprentice instructors.

The apprentice who clothes himself, buys tools, carries some protection, pays club dues, church and shop collections, is obliged to pay his nearest relatives for board, washing and mending in "promissory notes" (no time of payment specified), he must be blind on the girl side of the road and put the curb upon a growing sociability. All this hurts, it might be called "apprentice cramp," it squeezes the region of short rib and produces imperfect vision. A dime looks the size of a car wheel and it makes as many revolutions in his pocket as one going a mile a minute before it disappears into spend-land. I ought to go further and say it leads to defective hearing, for the jingle of small coin is so sweet to the ear, that many a fellow adds keys, nails and tool checks to swell the sound, so that in time he becomes stone deaf to the ring of real money. Apprentice cramp is a disease that carries off many of the first-yearers and deters many other desirable fellows from becoming apprentices; another trouble is the discovery that physically he is not adapted to the trade he has started, yet rather than start another at first-year rate he drops out. This is a loss to the railroad as well as the boy, and its up to them to remedy it. The high-school boy of today would be more inclined to mechanics than ever before, if the rate paid were more proportional to his wants.

The classroom is the smoothing iron that rubs out all the wrinkles of discontent, for the apprentice looks forward to these hours with pleasure. "Up to the college," has almost the ring of "come on to the ball game," and the class instructor is regarded as a "dad" by all the boys. Even the fellow who went in with a sneer goes out with a thank you. Next to the school is the club, which might be called the school of civics, as it is here that the apprentice spreads his wings for his first flight in oratory. Here he gets used to hearing his own voice and gets over the scare of the sound of it, here he also sharpens up his wits for defense or his tongue for attack and here he talks railroad, reads railroad and grows up to be a railroader.

The great disadvantage of apprentices in the railroad shops is the uncertainty of keeping the job. We are at the mercy of every foreman and we have no court of appeals. In many cases the class instructor stands our friend, but he is outside of the shop and cannot be expected to be judge and jury. The question we ask ourselves most often is this: What is the railroad going to do with us? And we answer ourselves thus: If the railroad does not want us, we have practically wasted our time. Take for example the apprentice who has served a couple of years at the machinist trade. His knowledge won't count for much outside the railroad shop if they see fit to fire him, and yet it is one of great value in the shop if they see fit to use him. Take the carpenter apprentice who can do anything from building a cab to laying track, lagging a boiler or wiring a shop. Of what use will this be to him if the railroad does not want him, and he has to seek work with a house builder? The railroad is big enough to be a life work for the most ambitious if promotion were arranged so that the apprentice would know where he stood as he went along.

[Mr. Keefe is a graduate of the Oswego, N. Y., shop of the New York Central Lines and is still located at that point.—ED.].

Making an Index Plate

BY J. C. DUFRESNE

The job being out of the ordinary, it caused much discussion and speculation as to how the plate could be developed, as it was understood that it was required to be accurate when finished.

First the index head on the milling machine was tested by cutting three slots in two steel disks which were 4 inches diameter by ½ inch thick. They were

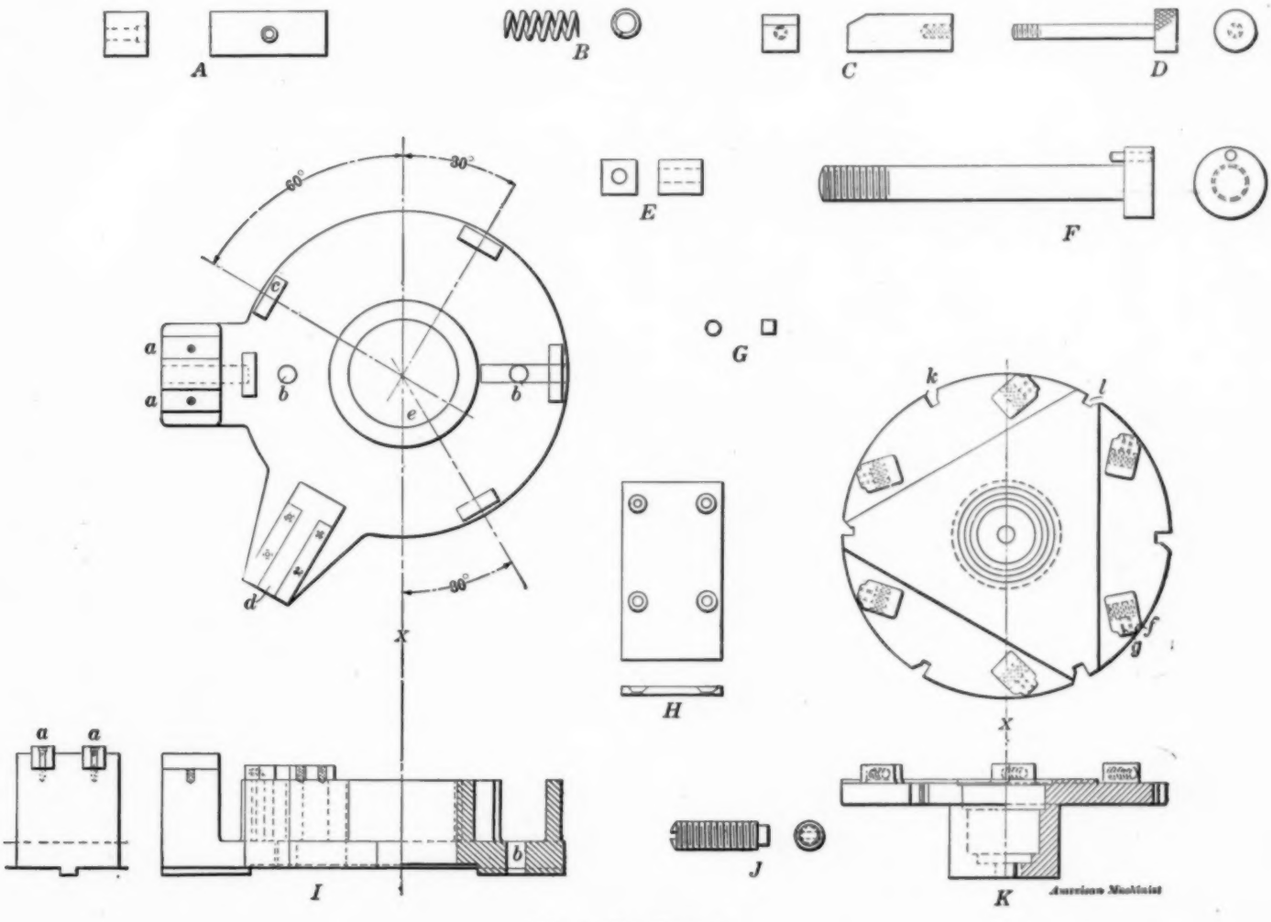


FIG. 1. THE FIXTURE

clamped on an arbor together, the slots cut, then one was turned end for end and placed against the other. The slots did not line up, so another method was sought which resulted in the following. This method can be used to index a drilling jig or planing fixture, it is much cheaper than the button system and there are less chances of making an error; also the plate can be tested while in the milling machine after the finishing cut has been taken by holding an indicater between two collars on the milling-machine

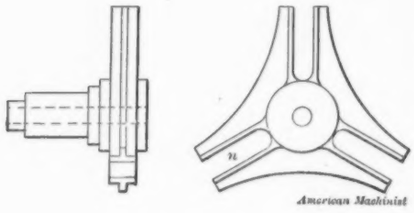


FIG. 2. THE SPIDER

arbor. Fig. 2 shows one of the pieces that the index was designed for.

On Fig. 4 *I* is the base. It is held to the milling-machine platen by two bolts at *b*. At *a a* are two hard blocks for setting the cutters.

At *c* are five legs on which the plate *K* is rotated around the hole *e*. The bolt *F* clamps plate *K* and spider, Fig. 2. together. The plate is held down by two clamps, the bolts go into the platen slots, the index pin *C* goes into the slot *d*, and is kept in the slots by the spring *B* which is backed up by the stop *E*. It is pulled out by the screw *D*. The cap *H* keeps *C* down.

The spider is located on the plate by the screws *J* which go into the bossses *f*. They are kept from shaking loose by screws at *g*. These have brass plugs ahead of them to protect the threads on *J*. A 1¼-inch end mill is used when finishing the slots at *n* in the spider. It is set about 1/32 inch from one block *a*. A roughing cut is taken, then it is set to the other block *a* for the other side. For finishing a piece of cigarette paper is held against the block and the cutter is moved over until it touches the paper. It is then moved past the block and fed over the thickness of the paper. The other side of the slot is finished in the same way and a 1¼-inch gage is used to check up.

DEVELOPING THE PLATE

After boring and turning, the plate was put on an arbor between the index centers of a milling machine, and six 5/16x7/16-inch slots were cut. The plate was then rotated about 0.005 inch and a finishing cut taken at the working side *k*, the index head being used to index. The piece *N*, Fig. 2, was forged and finished at *i* to go against the machine platen and two bolt holes put in.

The piece *M* was doweled to *N* and both set up so that *M* came back of *l* and scribed for the tongue *m*. *M* was then removed from *N* and rough milled to get the tongue *m* and finish milled on the top when on *N*. Next we tied a one-pound weight on the end of a 24-inch bar; this was used as a lever to keep the plate against *M*. To locate we moved cutter over 0.002 inch toward *M* with the face *k* against the cutter, set *l* against *M*, moved the cutter back to the center and took the first trial cut.

The object is to set *M* so there will be some to mill off from the top at *m* for the second trial cut. If the distance from the cutter to *M* is too short the cutter will cut on the face opposite *k* instead of at *k*.

If after cutting the six slots for the first trial we place *k* against the cutter and the distance between *l* and *m* is 0.006 inch (using Brown & Sharpe feelers) it is evident that the slots are 0.001 inch too far apart and 0.001 inch should be removed from the stop *m* and the next cut taken. To take this cut we placed a 60-degree cutter out near the end of the arbor and raised the table to get the cut, using a micrometer to check the amount removed.

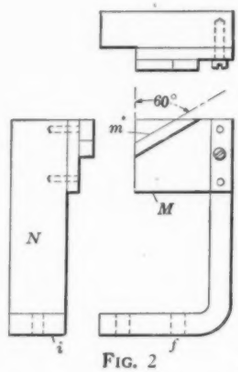


FIG. 2

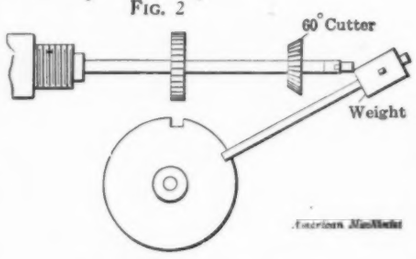


FIG. 3. THE JOB SET UP

It took four cuts to finish the above plate. The first cut we had 0.012 inch between the face *l* and stop *m*. We milled off 0.002 inch from stop m instead if moving it in 0.002 inch, the result was the second cut gave 0.024 inch between *l* and *m*. Milling off 0.004 inch and taking the third cut gave us 0.015 inch between *l* and *m*.

After removing a little from *m* with an oil stone we took the fourth cut and got a good job. We held an indicator on the milling arbor and the slots showed less than 0.001 inch error.

To rotate the piece we ran the tail center back, advanced the plate and turned it; a hight block under the plate kept the plate from coming off the centers. We screwed the tail-center screw up the same each time.

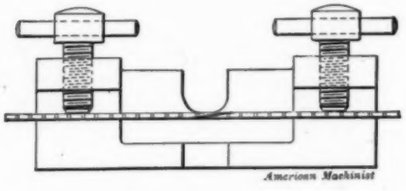
Fig. 3 shows the set-up cutters, arbor, index plate, lever and weight.

A Vise for Holding Band Saws While Brazing

BY J. H. TERRY

It is sometimes necessary to braze band saws after passing the saw through the work, as when cutting pieces out of the center of plates and the like. For this job I made the vise shown in the cut. It is made of cast iron and may be fixed to the machine table in two positions, as shown in sketch or with the saw teeth at right angles to the position shown.

Our method for brazing is to taper the ends of the saw, giving a splice about ¾ inch long, and using thin silver solder, with powdered borax as a flux, a heavy



A BAND-SAW VISE

pair of tongs made red hot supplying the necessary heat. Although the man in charge of the three bandsaws we have in use was a short time ago fully entitled to be called "unskilled," a little practice soon made quite an expert of him on this work, and also brought about an increase of wages and the prefix of "Doctor" to his name.

A mixture of flake graphite and grease applied to screw threads is frequently recommended as tending to prevent the adhesion of the parts due to rust or expansion from heat. Rather a novel recommendation in the same line, according to the *Motor World* is to the effect that mercurial ointment similarly applied serves an equally useful purpose. It was formerly employed in marine steam-engine practice in cases where the parts of the piston were threaded together. Some such provision should be made on all brake and radius rod connections about the car and any other parts which, though occasionally requiring adjustment, are ordinarily left to themselves in all weathers.

Letters from Practical Men

Concerning the details of making things in machine shops, from the first sketch to the shipping room. A letter good enough to print will be paid for. The value is in the idea—not the length of the letter

An Expanding Reamer

The accompanying cut shows a very rigid and sensitive expansion reamer designed for reaming automobile cylinders with a plus or minus allowance of 0.001 inch and to hold its size for a number at a time. This reamer is very easy of adjustment and very rigid and firm when set, while the thickness of the blades and manner of retaining them in place eliminates springing, thereby obviating chatter marks in the finished hole and spoiled work.

The body is made of machine steel, solid with the shank and bored out on the front end as shown along the dotted line *a a a*, etc., for the two nuts *d* to enter, it being necessary for the blades to bottom in the hole of the cylinder. One nut is to adjust with and the outer one to act as a check nut.

The stud *c* was made to be a tight screw fit in the body and a ringing fit on the larger end for the nuts *d* and pinned in the body.

This method of construction was adopted simply to facilitate the machine work, owing to the over-hang *a' B'* which, as will be readily seen, gives support to the front ends of the blades *f*.

The blades are made of high-speed steel machined all over and leaving 1/32 inch on the top for grinding. They are then hardened and ground a snug sliding fit in the slots in the body and at the same time ground on the two ends that bear on the adjusting nuts to an equal length. This is absolutely necessary to insure all of the blades being adjusted alike and to allow no play whatever endwise of any blade. They are then put into the head and set down to the smallest diameter when the screws *h* are screwed down solid, also the bushing *g* to press the blades firmly back against the supporting back side of the slot, which is accomplished by the taper flat on the bushing. After tightening the front and back adjusting nuts the check nuts are likewise tightened, thus supporting the blades at every point and securing them positively. The blades are then ground to the desired diameter and tapering back about 0.002 of an inch, after which they are backed off and ground on the chamfer.

This gives a perfectly true running reamer, the shank being ground at the same time as the blades and the nuts *d* and *e* being ground on their faces (after case-hardening) on a mandrel; being in contact with the corresponding surfaces of the blades insures their accurate adjustment.

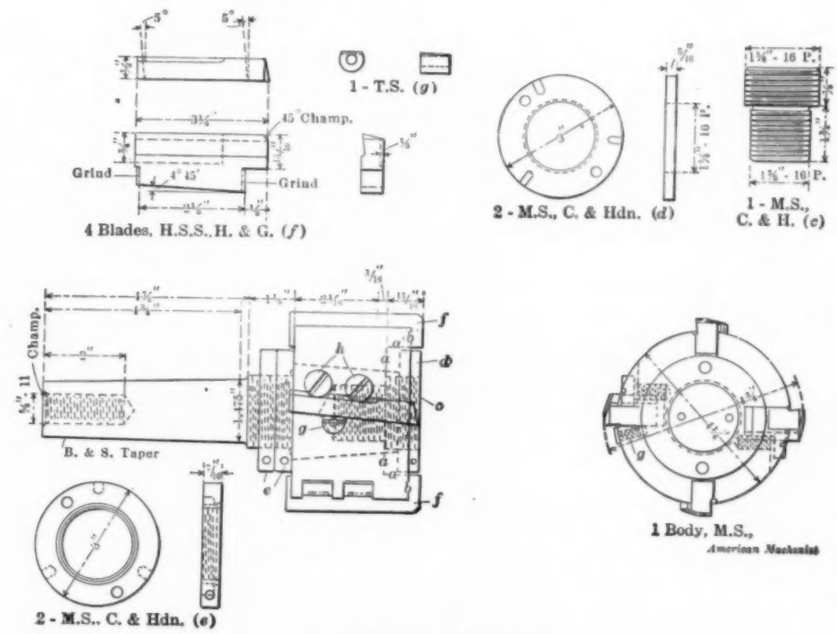
The angle of the blades with the axis of the body, viz., 5 degrees, gives a shearing cut to the extreme diameter and it is possible by stoning the blades properly to get a slight scraping effect which will give a very high finish to the hole, especially in cast iron, although to do this it is necessary to have the spindle of the machine run perfectly true.

The threaded hole in the small end of the shank is for a pull rod.

These reamers were used on a double head Beaman & Smith motor cylinder boring machine and gave excellent results, being used in something like 200 cylinders, if I remember right, without regrinding, requiring only stoning occasionally and setting up by the operator.

Should the machine spindle run out as it did on one machine and it being out of the question to repair it for the time being, it will be wise to true up the blades individually with a dial indicator by shimming with paper between either the front end or the back ends of the blades and the corresponding adjusting nut, as it is obvious that all blades must cut an equal amount.

Pawtucket, R. I. L. E. MIDDLETON.

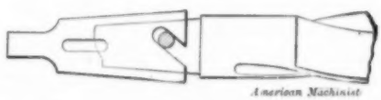


AN EXPANDING REAMER

Driving a Broken Tang Drill

The sketch shows a device I used on a drill press after the tang of a 2-inch drill had broken.

I drilled a 3/8-inch hole in the drill shank 3/8 inch deep and inserted a steel pin. I then cut a slot 3/8 inch wide in the socket and at an angle of 45 degrees, making it so that the taper of the shank was home in the socket before the pin was at the end of the slot.



DRIVING A BROKEN TANG DRILL

The effect is, the harder the pull, the tighter the drill. The wrinkle was wonderfully effective.

JOHN WILKINSON.

Jersey City, N. J.

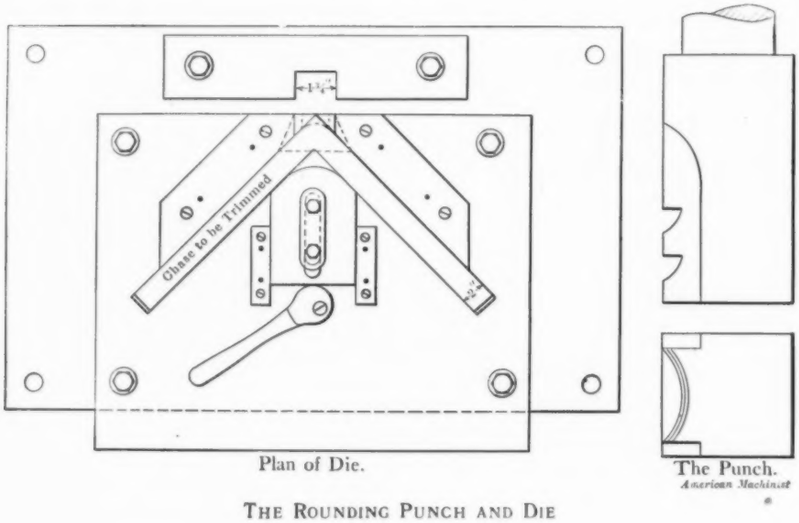
Rounding the Corners of Printing Press Chases in a Punch Press

That the power press can be used to advantage on many jobs, producing work much faster than any other machine, is universally conceded.

The accompanying cuts show how the square corners of iron chases ½x2 inches are trimmed to an arc of a ⅞-inch circle.

The punch, which takes three cuts on one stroke is held up to the work by a guide block at its rear. The piece of hardened steel under the corner of the frame to be trimmed, conforms, in outline, to the last cutting edge on the punch. The frame is held against the guides by the cam directly in front of the operator. The cutting teeth of the punch are on an angle, not shown in the cut, so as to give a shearing cut. The job is practically an external broaching operation done on the punch press.

Philadelphia, Penn. J. WALTERS.

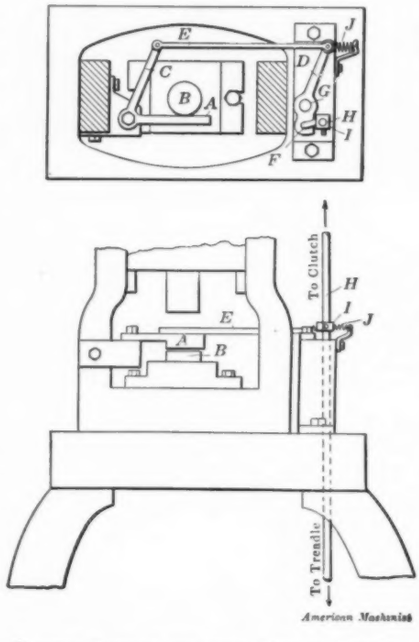


THE ROUNDING PUNCH AND DIE

A Safety Device for a Power Press

The cut shows a device which has been in successful use for some time for the protection of the operator on a power press. The work requires the placing of metal shells about two inches in diameter by one-half inch deep on the die. When the operator lost a thumb by tripping the press too soon, it was decided that some sort of protection was necessary.

The lever *A* was arranged to swing over the die *B*, the other arm of the lever *C* causing the lever *D* to move by means of the rod *E*. In the opposite end of the lever *D* is a slot *F*, concentric with the bearing *G*. The rod from the treadle to the press clutch is shown at *H*, and attached to it by means of a set screw is



SAFETY DEVICE FOR THE PUNCH PRESS

is necessarily removed from the press by means of a stick or tool, no danger is encountered in this part of the operation.

It is worthy of note that the addition of this device to the press did not result in any slowing down of the work.

Waterbury, Conn. J. R. PUTNAM.

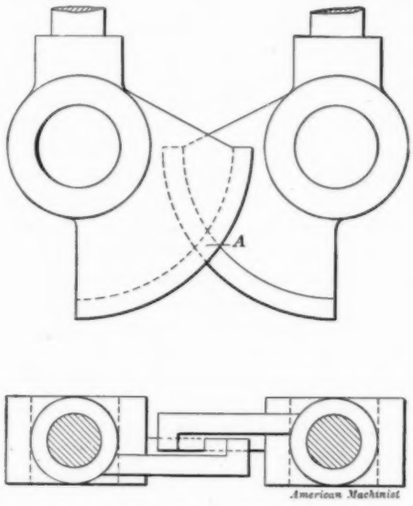
A Lock for Gear Box Levers

I inclose sketch of a simple but very reliable arrangement to prevent the putting into gear more than one clutch at the same time, and raising, as one reader puts it, "a sort of earthquake, and then a general mixup of things in the bottom of the gear box."

As will be seen, both levers have a flanged quadrant, cut away to allow of passing each other at *A*.

In the position shown either lever can be moved forward or backward, and at the same time it effectively locks the other until moved back again to central position.

Belfast, Ireland. TERRY.



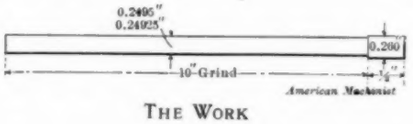
A LEVER LOCK FOR THE GEAR BOX

Grinding Small Drill Rod Pieces

In experimenting with different wheels in the grinding of the small, soft Stub's wire rod, as shown in the cut, it was found that a 24 combination, grade K, Norton alundum wheel was too hard. The piece would continue to spring in such a manner as to give the operator a lot of trouble so that it required 20 minutes to grind each piece. A 46-grain, grade I wheel was substituted and the pieces were produced in 3 minutes each. In the latter case, the free-cutting wheel allowed the operator to attend to the business of grinding instead of to that of juggling.

Worcester, Mass. J. C. SPENCE.

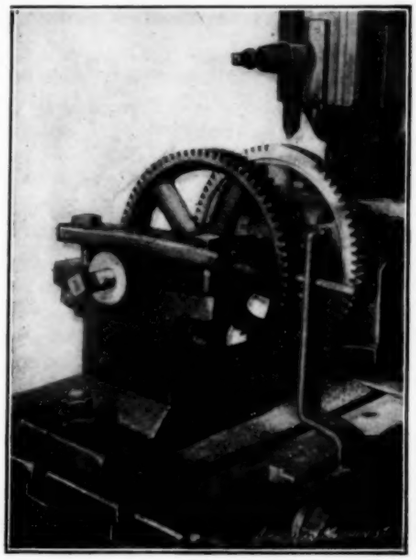
Superintendent Norton Grinding Company.



THE WORK

Cutting Spur Gears on a Shaper

The accompanying halftone illustrates a method of cutting spur gears on a shaper, that should be useful in emergencies when no milling machine or gear cutter is available. As will be readily seen, the gear blank is mounted on an arbor with a gear having a suitable number of teeth, which should be some multiple of the one to be cut. The arbor is mounted on two V-blocks bolted to the shaper table and is clamped in place



CUTTING SPUR GEARS IN A SHAPER

by straps, the indexing being accomplished by means of a pin engaging the gear teeth, which is set into a piece of springy strap iron clamped to the side of the shaper table as shown.

Athens, O. W. M. SECOY.

A Multiple Combination Blanking and Forming Die

The sketch herewith will show how four different-sized disks are made at one operation, as shown in Fig. 1.

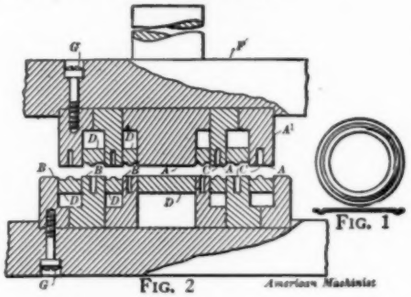


FIG. 1

FIG. 2

A MULTIPLE COMBINATION DIE

The cut does not need much explanation; it is a regular compound die, and merely shows the idea of making four pieces at once. Much time and labor can be saved on a job of this kind in large quantities. Fig. 2 shows the die.

A A A are the cutting punches. *B B B* are the dies; the grooves *C C C* do the forming. *D D D D* are strippers; they also act as formers. *F* is the punch holder; the screws *G G* show how the tools are held in the upper and lower holders.

The die was made with guide pins, and the necessary stripper springs and pins (not shown).

The cut shows only one view, as the die is round. No stripper is shown on the outside of the punch at *A* 1, as the stock was stripped with a special attachment on the power press. The largest blank was about 4¾ inches diameter and the stock used was about 0.012 inch C. R.

Rockford, Ill. CHAS. EISLER.

Relation of Manufacturers and Dealers

In the relation between manufacturer and dealer there is to be found a large field for standardization. Agreements between maker and vender of machine tools are as varied as their numbers. The same maker may have as many different agreements for the sale of his machinery as he has agents, and the dealers have by no means uniform contracts.

One of these points of difference is on the statement of the ultimate selling price by the builder. The builder may stipulate that he will sell to a consumer at a given price and give a dealer a discount from that price to compensate him for his selling expense. The dealer will often reserve the right to sacrifice part of his commission to make a sale. This causes trouble because a purchaser may find that he can buy at a lower price from a dealer than he can direct.

Again, if the builder wishes to establish a price to the ultimate consumer he may practically publish that price by sending quotations in answer to inquiries for catalogs. To this the dealer replies that if the purchaser knows the price, it may be impossible for his salesman to get an interview, and that he may be unable to explain to him the finer points which justify the placing of the order at a higher price than that asked by his competitors.

The user's reply is that it is a pretty poor salesman who cannot get an audience when a purchase is actually to be made; also, that every purchasing agent knows that there are differences in machines as well as in prices; also, that any purchaser can easily get, by insistance, quotations from the dealer before granting an interview.

It appears to me that the evolution of the business conscience will go on to the point where the one-price system will extend to machine tools as well as groceries and clothing. It seems that the manufacturer is entitled to cost plus a reasonable profit on the machine at his door, that the purchaser should stand also a reasonable cost of selling. In fairness this should be the cost of selling to him, but in practice, it will probably be the average cost, though it should not be increased by the fact that the machine is sold through an agent. The agent's net profit should be that saving in the cost of selling that can be effected by an organization which is beyond the scope of any but the larger manufacturers.

I believe that the temptation on the part of dealers to cut prices or concede freight, even out of his own commission, should be avoided. This would leave the salesman with quality, design and delivery as his principal arguments, and this, I believe, is as it should be.

Boston, Mass. CON WISE.

Peculiar Case of Shrinkage

The peculiar result of the action of heat on a steel drum is shown in the accompanying halftone. The drum forms part of the equipment for a new metal-

PECULIAR CASE OF SHRINKAGE

lurgical process. It is 7¼ inches diameter by 6½ inches face, the face being ⅛ inch thick. In use it is mounted on a spindle and run at about 1000 revolutions per minute, water being circulated through it all the time, while thin streams of molten metal are allowed to fall on the upper surface. The effect of this combined heating and cooling has been to contract the drum until it is ⅛ inch less in diameter than when made. The ends, which are supported by disks, remain the original size. This is the second time the drum shown has shrunk. It first got out of shape after two or three months' use, and was then returned. It is now being replaced by a somewhat thicker drum, which will be supported internally along its whole length.

It may be remarked that this drum and another which has shrunk similarly,

have been subject to the action of molten copper. Others which have been used only with metals having a low melting point, such as lead and zinc, do not appear to be affected.

London, England. B. L.

A Magnetic Chuck with Concentric Circular Poles

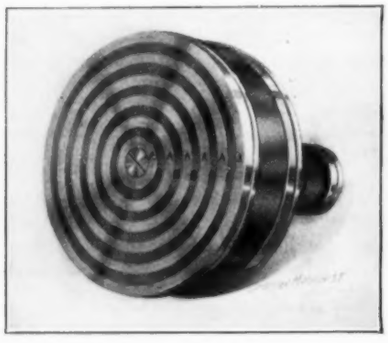
We had a number of thin, steel disks to finish. They are 12 inches diameter by about ⅛ inch thick, in the rough. This material was a very high-carbon tool steel. It was necessary that they should be finished very smooth and of equal thickness throughout, although it was not necessary that the plates be duplicates. The disks came ready punched to size with a hole in the center. Obviously grinding was the way to finish, but the problem was to hold them. This was solved by making the magnetic chuck shown in the halftones, Figs. 1 and 2 (this chuck we made and used), and in Fig. 3, the layout of a larger size which, however, was never built.

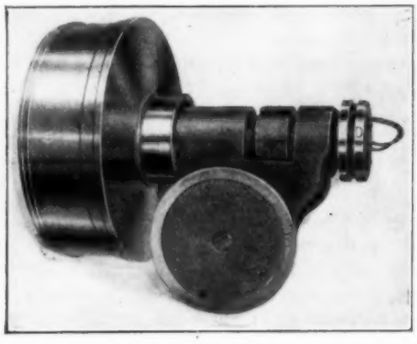
The disks were fairly flat in the rough. They were centered on the projection in the center of the chuck and the current turned on. The gripping was enormous, the disks were drawn out almost flat. This, of course, on some work would be an objection, as on releasing the work after grinding it would spring out of shape again; however, with these disks the object was to get them parallel within a thousandth or so, and only *approximately* flat.

The illustrations need little explanation. In Fig. 1, *A* are the concentric magnetic rings, shown under the same letter in Fig. 3. They are secured to the back plate *F* by the screws *C*. The rings shown at *B* were made of brass in the chuck shown in Figs. 1 and 2, but any nonmagnetic metal, such as babbitt metal, would do. The coils occupied the spaces *E*, Fig. 3. At *D*, Fig. 2, is the slip ring upon which the brushes bear.

The device, as shown in Figs. 1 and 2, was used on a Landis grinder, and the work turned out was highly satisfactory.

Pittsburg, Penn. H. R. S.





FIGS. 1 AND 2. MAGNETIC CHUCK WITH CONCENTRIC CIRCULAR POLES

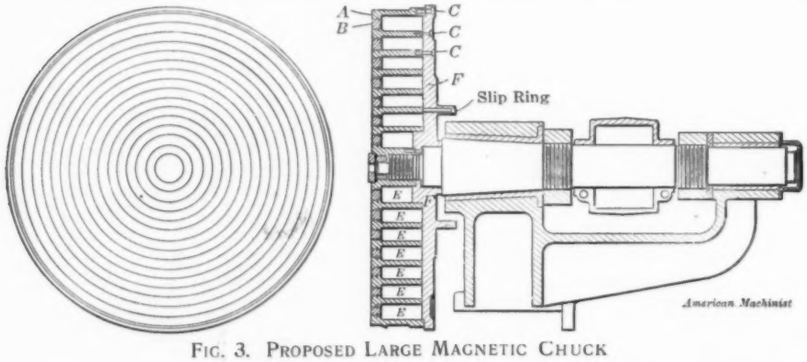


FIG. 3. PROPOSED LARGE MAGNETIC CHUCK

Gang Milling Sawmill Head Blocks

Formerly this work was all done on the planer and a first-class planer hand could finish a piece in about half an hour. With the increase in business the planers became crowded beyond their capacity, and as an experiment we tried milling one piece. The experiment was so satisfactory that we now mill them in gangs of six on a heavy Newton milling machine. The time for milling six pieces is 45 minutes, a trifle over seven minutes each, and each piece the same as every other one.

Fig. 1 shows the first operation, milling the tops of the cast-iron head blocks.

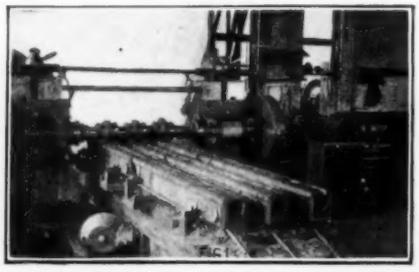
Fig. 2 shows the pieces (turned over on the faces finished in the first operation) being milled on the bottoms. In this operation the pieces are set across the table, as there are lugs on the bottom which must be milled at right angles to the length of the head block.

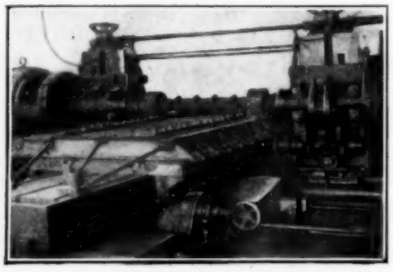
Fig. 3 shows the milling of the inside of the head block. This is somewhat similar to milling T-slots, except that the cutter bears on the inner end only, except at spots.

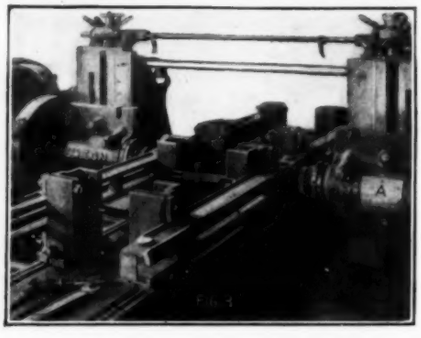
In Fig. 4 is shown the auxiliary head, which is shown in use in Fig. 2. We made this attachment in the shop here. We removed the spindle cap and cut a hole in the middle of it, which is shown covered with a piece of sheet iron *A*, in Fig. 3. The spindle was then removed and gear teeth cut on it in line with the hole in the cap. These teeth drive the train of gears which drive the spindle of the attachment. When not in use the sheet-iron cover excludes dust, etc.

H. H. ESBENSHADE.

Waynesboro, Penn.







MILLING SAWMILL HEAD BLOCKS

Discussion of Previous Question

Estimates for Building Motors

Letters from our readers showing how many men of many minds look upon various subjects opened up in previous numbers

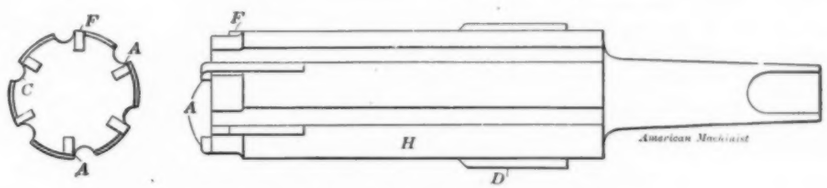
Under any and all conditions I would grind the base, and for this reason I would see that there be no more finish allowed for than to suit this purpose, the grinding to be done on a disk grinder.

Making 25 Cylinders per Month

This means finishing one cylinder per day. In this case we may suppose that the shop contracting to do this work is equipped to do any kind of work and has a fair assortment of machine tools, such as lathes, drill presses, milling machines, etc.

Beyond the simplest kinds of fixtures, such as may be necessary to fasten to the surface plate of a lathe while boring cylinders, some simple tap guides, the necessary counterbores and a tap for the 2-inch tapped holes, which, I suppose, have special threads, I would hesitate to make any tools, for it should not be a difficult task to finish one cylinder per day.

Where 25 cylinders per week are required, the problem is a little more exacting, but may still be tackled in a machine shop, only that more expensive tools are needed. In the first place it might be necessary to design a grinder, if the prospects for the future justify such a step, which, of course, would have to be as simple as possible. The disk would be horizontal, and provisions made to increase its usefulness for other purposes or for a greater output.



Boring Used for Building Motors

The next tools would be a jig and a boring bar. The jig must be such as to take the cylinder by the base, center it by the exterior of cylinder, but exert no pressure there. The jig should have slip bushings for the tapped holes, one kind for drilling, the other for tapping purposes. After securing the cylinder in the jig, the first operation should be to perform the drilling and tapping at the top. This done, a plug should be placed in the jig and cylinder, its purpose being to support the castings more securely while other cuts are being taken.

Now the jig should be turned upside down and the large hole bored (also the bolt holes). To bore the large hole I would provide the boring bar shown, in which H is the bar proper, having cutters A, F and D, and the longitudinal grooves C. A are roughing cutters and project beyond H; F are finishing cutters and are larger in diameter than A and a little above, their finish allows for grinding. The body H is of the same diameter as F, so that it may fill the hole and thus provide a continuous guide for the cutters as the bar descends. Properly located in the bushing guiding the bar are slots to permit the cutters D to pass through. These do the chamfering of the cylinders.

All the tapping is to be done while the cylinders are in the jig. The finishing of the bases may be done on the milling machine by providing a fixture consisting of a plate, to be firmly held on the milling-machine platen, this plate to have an arbor, which fits nicely into the bore of the cylinder, and a stud in register with the bolt holes. Finally suitable means to quickly fasten cylinder to plate.

Grinding Cylinders

To grind cylinders internally a fixture should be made to aline them by the top hole and clamp them to base B. This fixture need not be elaborate on expensive but rigid and accurate. The grinding may be done on a lathe, if a grinder is not available, and it need not be an expensive affair either.

Making 25 per Day

Making 25 cylinders per day will require entirely different tools, and the problem may be changed to saying that the cylinders must be finished at the rate of one every 21.6 minutes. This is beyond a man's ability, and tools must be provided that make up for this deficiency.

First of all our disk grinder must be so designed that one or two cylinders are being ground while one is being removed and another one replaced. This, of course, will be a more costly machine, but need not be too expensive. The next requirement is a special machine so as to quickly take and securely hold the cylinder by the base to drill, ream, tap, bore, face and grind the cylinder simultaneously, drills, taps, counterbores, etc., to be held on bars which are brought into action by turrets and rotate and slide only at the time of actual cutting.

The grinding must be performed on the same machine, but after all cutting has been performed. This is perfectly feasible, for the cutting of the large hole should take no more than three minutes, and the grinding seven minutes, or at the most 10 minutes, leaving 13 minutes for the setting.

As to the cost of the different equipments this is a more difficult problem to solve, unless we could go to work to design the different tools and then figure costs. However, the first case should be satisfied with an expenditure of $50, while case No. 2 may require about $250, or even more. Finally, case No. 3 may cost from $2000 to $3000. In the first case a good machinist will be required to do the work, one of the old-time kind, while in case No. 2, a less skilled man can handle the tools and work quite satisfactorily; and in the last, lower-grade men can use the special tools and fixtures.

Pittsburg, Penn. E. Lawrenz.

The Foreman's Voice

On page 80, under the heading "The Foreman's Voice," is an article so nearly paralleling my own experience that I could not refrain from stating it. Upon dismissing a machinist from our employ I told him that he was not getting his work out fast enough. I told him I did not understand why some men will not work as well for a man who tries to make everything as easy as possible as they do for the foreman who shouts and swears all the time.

His reply was that because I didn't shout he thought that I didn't care. The man next to him on the bench was getting out twice as much work as the man discharged, and, should I have started shouting to suit the discharged man, the

good man would not get out as much work as he was already doing.

It is evidently necessary to study each man's disposition, but you cannot change your own to suit them all.

Cleveland, O. F. F. DURANT.

German and American Industrial Education

The paper by Professor Carver, of Harvard University, on "Economics of Industrial Education," printed on page 1181, Volume 33, Part 2, as read at the Boston meeting of the Society for the Promotion of Industrial Education, gives as the editor suggests, some convincing facts. That these facts may convince others differently is, of course, possible. Just now I feel that his arguments, together with a few well known facts not stated in his paper, make necessary a conclusion that is quite different from his.

His conclusion would lead us to follow Germany's lead, which, while apparently good for Germany, would, I believe, be bad for America. Germany has endeavored to fill the ranks of executives by its system of technical education, and it has attempted to relieve the great mass of unskilled by the introduction of continuation schools. The effect has been that an artificial redistribution of men has resulted with a great growth in the prosperity of the country as a whole along mechanical lines but with great loss to the individual worker. There can be no doubt that Germany has flooded itself with great numbers of educated men, laboring under the delusion that they are executives but who are working for from $12 to $15 per week. Further, by its system of continuation schools in connection with a widespread apprentice system it has drawn into the ranks of workers in skilled industries large numbers of boys and men who are not fitted by nature to become skilled mechanics.

Germany has built on the education of the brain without educating the hand. True industrial education is well balanced education of both hand and brain. Germany says to a boy, "We see you cannot do a good job at scraping; throw down your scraper and we will teach you how to reason, then you can go back to the shop and reason how you should scrape." True industrial education says to the same boy, "Here, we will teach you how to scrape step by step and we will have you practice what you learn at every step."

In other words a system of education that seeks to redistribute men, must recognize that men were born the way that they were, and that it takes generations, rather than months to breed a race of mechanics, and that the little change that can be made in our generation must be made slowly and built solidly.

I agree with Professor Carver that there is the greatest supply of material among the unskilled, and I would also call attention to the fact that the greatest supply of children to form the next generation comes from this same class; also that the best time to begin the education of a child is before he is born, a hundred years preferably, but a few years is better than none.

Again executives, German opinion to the contrary notwithstanding, are born not made. Our system of technical colleges is admirably fitted to sort out and weed out the material that offers itself as candidates for executive positions. To be sure, they often make mistakes but that does not alter the principles. If any other improvement than the lessening of these mistakes is needed, I would suggest that some method be found of weeding out the non-executive minds earlier in life so that the resulting bump, when they reach their limit and drop back, may not be so severe. Something of this kind would likely bring forth a larger number of candidates who aspired to executive places, which is no argument against the plan.

Again, the system of industrial education that will succeed in this country must build on the firm basis of actual practical work under instruction that instructs. This must be supplemented by instruction in the "why" of the thing.

This education will just as surely weed out many of those who are already in the unskilled class, as the technical school will from its candidates. What shall be done for this largest group of all, whose children and grandchildren are to be our working people of future generations?

This is a serious problem, one of the most serious in life. To be sure we all recognize the necessity of the three R's, though we may not recognize that thoroughness is not to be had in these studies or any others from the very class of people that we are discussing. If it were to be had, there would be no problem. The question then is to hold these people's children in school long enough for them to absorb what their brighter playmates have so easily absorbed at the usual school age. It is, of course, recognized that the greatest and most prompt defection from school comes from those who need it most, if only to make thorough that which they have already been over.

If, as appears from the economic necessities of the country, these boys and girls must go to work, then there appears to be only the night school, or the continuation school. The night school can only be made voluntary, and, therefore, inapplicable to those who need it most. The continuation school can be made compulsary. Here we are back hot on Germany's trail *except* that I feel that here is that great opportunity for which the public-school system has been searching. Theirs is the task to make of the boys whom nature has intended for diggers of ditches and carriers of mortar, better men, better citizens with a better appreciation of what success really is and what the world can offer to a poor man who knows how to ask it. In other words, here is the grandest opportunity in the least worked field of education, to take the dullard and make of him, not an engineer, nor a skilled mechanic, but a man who may become the father of a generation that may become mechanics and engineers.

Springfield, Mass. ENTROPY.

End Motion of a Rotating Journal

The article contributed by Lucien E. Picolet on page 1112, Volume 33, Part 2, interested me, because it is a problem I had frequently to explain some years ago from the real working machine and, since reading the above article, I have concluded my explanation was, in a measure, a little off.

The Straight Line engines were, before the direct-connected age, built with a quarter of an inch end play in the main bearings and crank. When running, say 250 revolutions, with 2-ton flywheels and 4¾-inch shafts, it was easy to slide the wheels and shafts back and forth with a match. My explanation was this:

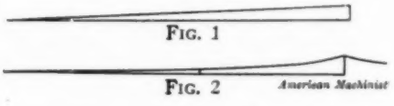


FIG. 1

FIG. 2

END MOTION OF A ROTATING JOURNAL

In making, say three revolutions, the journals were sliding about four feet, and the match moved them ¼ inch. Thus, what the match had to do was to make up the difference between the base and the hypotenuse, where the base was 4 feet and the perpendicular ¼ inch, which was very little and, as small as the match was, it was equal to do that little work. That explanation is not as scientific and possibly not as readily understood by the school men as Mr. Picolet's; but it is the same in principle, shorter, and may be as comprehensive to the mechanic.

Fig. 1 is a diagram illustrating my original notion; but, now I question if that is correct. For, would not a uniform pressure on the match cause a dot on the journals to travel on a curved line, as shown in Fig. 2? The evidence was pretty plain that this was the action, for, when the shoulder brought up against the fiber washer, the wheels would bound back.

Syracuse, N. Y. JOHN E. SWEET.

Heat and Cooling Treatment

In James H. Baker's article on page 19, Volume 34, Part 1, he states that there is no mystery whatever about the heat and cooling treatment of steel, but in this well written article of his why does he not go farther and give us the temperature for hardening or annealing certain steels or for reducing crystal to fiber?

A statement of his: "To assert that the Government should not treat gun steel or armor plate would be to proclaim oneself fit for an insane asylum," is certainly true, as no Government inspector will accept armor with crystal, so this armor must be heat treated to put it in a fiber state. Now, right here is what some may call a mystery, for it is a fact that this treatment is more or less a secret. If we knew at what temperature to change crystal into fiber and how to quench, there would be no mystery at all, and all users of steel would take the treating as a matter of course, and the result would be that everyone would get the best results from steel according to its chemical content.

Munhall, Penn. G. W.

Unusual Slotting Job on the Planer

That job of facing the feet of some cast-iron columns at the works of the Riehle Brothers Testing Machine Company, described on page 1057, Volume 33, Part 2, is one that may frequently come around in general engineering shops, and we cannot but admire the initiative of the man in charge of the particular job referred to. It is plain the job was a perfect success; but what about the cost of the gear? I am afraid it was high, and notwithstanding its cost was limited in capacity. Suppose some day another job comes along requiring an inch or two more stroke than the stroke of the one he has, then he will have to make a larger one, will he not? Or perhaps he will do that which probably might have been done in the first case; that is, plane a small section and then move the work, so that the column might be faced on a machine of much less stroke. Possibly, however, he, in common with other machine-shop foremen, had no voice in the design but had to take it as it came and do it as best he could. Now, it has been my experience to be faced with similar work and, until I got our bosses in the humor to purchase an open-side planer from the Detrick & Harvey Machine Company, we had to make do with a rig-up of our own, which simply consisted of taking two good, strong angle plates, 2 feet 6 inches by 2 feet 6 inches by 3 feet, such as are used for planer work, and bolting them on the side of the planer bed (not the table). Then by bolting one of the large planer-tool boxes to an angle plate bolted to the planer table, we were able to plane the feet of large columns, *A* standards, and in fact anything which was required of that description, and whose length was too great to pass the housings, the work being bolted to the two angle plates which were bolted to the planer bed, while the tool traveled past it with the movement of the planer table.

The complete rig-up cost only a dollar or two and has returned its cost many times.

J. T. TOWLSON.

Silvertown, London, England.

Drilling with a Two Man Machine

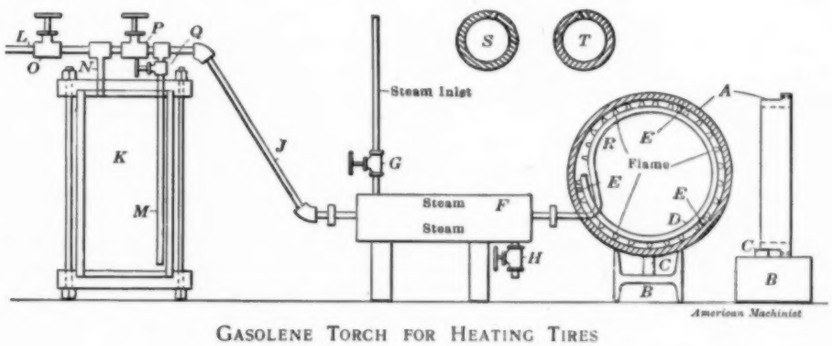
Once upon a time, either in an editorial or article, mention was made in the AMERICAN MACHINIST about one man on two machines or two men on one machine. In some work at the works of the Straight Line Engine Company, there was a large tank nine or ten feet in diameter in which 91 one-inch holes had to be drilled through 1⅝ to 1¾ inches of cast iron. The tank had to be set in three positions on the machine to admit of their being reached by the radial. A Celfor drill was used, and from the time the crane chain was hooked to the tank until the last of the 91 holes were finished in exactly 27 minutes. This was a two men on a one machine job. A little time was lost in waiting for the crane.

Syracuse, N. Y. E. E. T.

Gasolene Torch for Heating Tires

I noticed an article on page 883, Volume 33, Part 2, "Gasolene Torch for Heating Locomotive Tires." Accompanying is a sketch and explanation of a torch which I have been using for the past few years for practically the same work; but, instead of heating and shrinking tires, I heat and shrink steel flanges on steel shells, these shells varying in size from 20 to 72 inches in diameter.

Referring to the illustration, I place flange *A* in I-beam *B*, which is about the handiest thing to be had. The flange is supported by a block of iron *C* to keep it from falling. The burner *D*, made from ½-inch extra-heavy pipe, is then placed inside of the flange and supported by three iron blocks *E*. *F* is a steam reservoir, *G* is steam-controlling valve, *H* is valve to bleed water from *F*. *J* is a gasolene reservoir holding 15 gallons, *L* is an air pipe, *M* is gasolene pipe and comes within 1 inch of bottom of *K*. *N* is an air pipe to *K*, *O* is controlling air valve, *P* and *Q* are the valves which control the mixing of the air and gasolene.



GASOLENE TORCH FOR HEATING TIRES

Assuming that everything is in readiness to light burner *D*, place a small piece of cotton waste between *D* and *A* and light with a match. Open air valve *O* as far as possible, which allows the full air pressure (I use 100) to enter *K* and forces gasolene into pipe *M*. Then open valve *Q* a very little, allowing gasolene to enter burner *D* through pipe *J*, which passes through steam reservoir *F*. This gives a large flame which you do not want, so open valve *P*, which allows the air to mix with the gasolene. By using the mixing valves *P* and *Q* you can control the flame to whatever size you want.

By passing pipe *J* through reservoir *F*, we heat the gasolene and, as you will notice, I lap the burner so as to secure the benefit of what heat I can get at that point so that by the time the gasolene arrives at a point *R*, it has formed a gas and gives you a good hot flame, a very light blue in color.

The holes in the burners are about two inches apart and 1/16 inch in diameter, and are drilled on an angle so that the flame strikes the flange in two different directions with about 3 inches between the flames. The holes are drilled as shown at *S* and *T*.

After the flange has become hot enough, taking about 20 minutes to reach a dull red, close valve *Q*, extinguishing the flame, then close valve *P*. We then pick up flange with traveling crane and place it in position on end of shell.

The whole operation for a 40-inch flange consumes about 40 minutes, and about five gallons of gasolene to a flange.

Of course it is necessary to have a burner for each size of flange; the burners should be about 4 inches smaller in diameter than the inside diameter of the flange. This rigging was inexpensive, as the two reservoirs were taken from the scrap pile.

CALVIN G. FAUST, Foreman,
Carbondale Machine Company.
Carbondale, Penn.

Payments for Copies of Patents

In a recent issue a correspondent suggested that the post office sell certificates for the purchase of patents.

That is a good idea and ordinary postage stamps could be used as the certificates. The Patent Office will at present accept post office money orders that involve a lot of bookkeeping but will not accept stamps which involve none.

For instance, the Patent Office could make a rule that postage stamps of the required amount attached to a standard government postal card, like extra postage, would be acceptable. The post office could allow the Patent Office credit to the value of the extra postage on such cards when presented to the post office for payment same as they do when the Patent Office presents a money order for the same purpose now. The postal cards, being all government standard size could be filed card index style after credit had been allowed and the Patent Office has its record of orders filled anyway, so no extra bookkeeping would be required. The cost of patents bought in this way could be made a cent or so more than when money orders or cash is sent and this extra payment could go to the post office.

Scottdale, Penn. F. D. BUFFUM.

Loyalty

On page 35 is an editorial on the above subject, with which I take issue, at least in part. I join with the AMERICAN MACHINIST in deprecating the number of men who will follow instructions that they know to be wrong; but believe the trouble lies more with the foreman than with the men themselves.

I believe that most of the men in the shop who do this, do it because in previous instances when they have called the foreman's attention to some error, they have been practically told to mind their own business. If my belief is correct, it would on investigation be found that the men in the shops who do this kind of thing are collected under one or two of the foremen, while the rest of the shop is practically free from evil.

An example of this, but higher up, recently came to my notice and may be of interest to illustrate the point. A jobbing shop was doing a great deal of work for a glass works in the neighborhood. The job in question was to make molds for six bottles, of the same shape but different sizes.

In looking over the blueprints the superintendent discovered that while the dimensions increased proportionately with the size of the bottle, that in one case a certain dimension was made smaller than for a size smaller bottle. He had frequently been treated sarcastically by the glass-works people for questioning the correctness of their prints, and given to understand that they knew their own business and wished he would mind his. As a consequence, he went ahead with the work. The mold was worthless, but he lost nothing, as his company received full value for the work made to the plans.

Of course, the superintendent should have been loyal to the glass-works people, and have reported the mistake in time, but like many people with a sore head, he refused to be sat on again and decided to get square.

Chicago, Ill. B. J.

The editorial entitled, "Loyalty," at page 35, is alone worth the price of admission. Buy a copy and read it.

There are, however, many phases of the subject, many peculiar instances of environment, many turns to that elusive thing which we call human nature. It often happens that the kicker, the satirist or the "surly brute," is in truth the really loyal one, while his smooth spoken, honeyed associate, who so pleasantly agrees with everyone, is in fact the man who fails in loyalty when real emergency tests him out.

Confessions and personal experiences seem in vogue; here is mine: When working on the board I wrote a little article for the AMERICAN MACHINIST, which appeared at page 1221, of the issue of August 27, 1903, containing this statement: "A man who really is a man, in the full sense of the term, will be loyal to his employers, and whenever the time comes that he cannot concientiously be so he will seek a new position." At that time I believed this unreservedly and acted accordingly.

Three years of persistent effort won recognition to the extent of $125 per month. Meanwhile I had been discovered by outsiders and offered more money with a future. Facing the proposition of being shortly transferred to work under a man for whom I had no personal respect or accept the proffered position I chose the latter and gave service loyal to foolishness.

In seven months I was stuck for $500 and "dumped" upon a world unresponsive to the "fired" man. While loyal to my employer, that employer had not been loyal to me. Loyalty, like the grand passion, must be reciprocal if benefit to all parties is to result.

When the time comes that one cannot conscientiously be loyal, what then? The editorial referred to and my own statement quoted say, get out. Beautiful in theory but often a hardship in practice!

If a man has no personal encumbrances more important than a banjo he can be the free lance suggested, but there are things beside one's employer and one's self esteem to which the true man owes allegiance. There are positions in which an angel from heaven could not long remain loyal. These positions must be filled by someone. There are circumstances which almost irrevocably place a man in such positions against his inclinations. There is such a thing as injustice, then someone must bear it. To say that "life is what we make it" is to say that we are so nearly omnipotent as to completely negative the influence of others.

What is the answer? I know not, but for me I drink to the health of the man who gives unreserved loyalty to that which in his judgment has the highest claims upon him and who renders unto his employers efficient service coupled with all the loyalty he can consistently give.

M. C. JACKSON.
Philadelphia, Penn.

Amount of Air Passed Through Fuel Bed to Burn It

Referring to the article on "Producer and Water Gas for Furnaces," by L. B. Lent on page 1061, Part 2, Volume 33, I notice the following statement:

"When coal is burned in a furnace, from four to ten times the theoretical quantity of air is passed through the fuel bed in order to properly burn it."

The facts are that when coal is properly burned in a furnace, such as the furnace of a steam boiler, the air supply under the best conditions is not more than one and one-half times the theoretical quantity. Taking one pound of carbon burned to CO_2, and developing 14,600 B.t.u., and one and one-half times the theoretical air supply (the specific heat of the gases being 0.24), the resulting theoretical temperature is 3325 degrees Fahrenheit above the temperature of the atmosphere. If the air supply is four times the theoretical amount, the elevation of temperature is only 1298 degrees, a dull-red heat; and if ten times the theoretical amount is used, it is only 522 degrees. At this temperature the fire would go out because it was far below the temperature of ignition. The calculation is made as follows:

W = Total weight of gases per pound of carbon = total air supply + 1 pound,

C = Specific heat of the gases,

T = Elevation of temperature above the atmosphere.

$14{,}600 = WCT$. $T = 14{,}600 \div (WC)$

New York. WM. KENT.

Change Wires Occasionally

On page 914, Volume 33, Part 2, is an article entitled "Change Wires Occasionally," that in my experience as shop electrician states some conclusions drawn from a mistaken inference.

After describing a line that is grounded in its conduit, the writer states that when a person standing on a damp floor receives a shock from a socket, the cause is a short-circuit between the flexible wires. This cannot be the cause; the fault is in the insulation of the socket itself without regard to the flexible cord.

Again, when a light suddenly goes out and relights on moving to another position, nine times out of ten this is due to a break in one of the flexible cords, and not to the passage of current from one cord to another.

This break comes from two causes: First, repeated bending, causing a strand or two to part; then, the slight arcing from these ends when motion occurs that causes them to touch and separate, gradually eats through the remaining strands, causing the break. This break sometimes causes a short-circuit between the cords if the arcing is strong or strands protrude.

In most cases it is not necessary to change the whole flexible cord, but splice a piece on where the break occurs.

Peterborough, Ont., Can. A. B. C.

Diameters of Shell Blanks

On page 75 J. L. Moore calls attention to the fact that the formula in my article on page 931, Volume 33, Part 2, for obtaining the mean hight of a shell is incorrect.

I will say before going further, that he is correct in his strict view and was justified in criticizing the formula. I, personally, think the formula is very handy and simple, and answers for most practical purposes. It was an oversight on my part in not stating the formula as an approximation.

The portion of the article in question perhaps would have been better understood if stated thus: If it is desired to reduce the thickness of the metal in one or more drawing operations, find the mean hight of the shell by the following formula which is an approximation, but when the reduction is not greater than ⅕ the thickness of the metal before drawing, it will give close, practical results.

$$m = \frac{ht}{T}.$$

where

m = Approximate mean hight of finished shell;
h = Hight of finished shell;
t = Thickness of finished shell;
T = Thickness of metal before drawing.

Comparatively short shells are formed in one operation in most cases; this would limit the amount of reduction in thickness of the metal on account of the metal breaking. The formula will give very close results on cut and drawn shells.

I calculated the table shown on page 931, Volume 33, Part 2, to use, and sent it to the AMERICAN MACHINIST so others not having one could use it; but, if I had to use an elaborate formula before using the table, I probably would calculate the whole shell and satisfy myself what the diameter of the blank would be, and I think others would do the same.

Suppose we figure out a shell to determine whether we can use the formula to advantage, or not; or if it is worth keeping to use with or without the table. It was for the sake of simplicity that I chose the shell 2 inches diameter, 6 inches long, 0.020 inch thick, metal 0.040 inch.

Let us take a shell that can be drawn in one operation, not reducing its inside diameter, to simplify calculations. Say a shell 4 inches inside diameter, 3

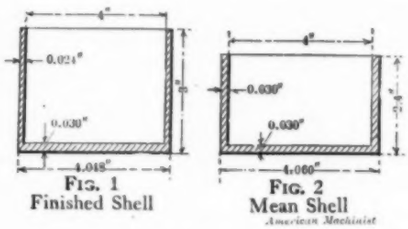


FIG. 1 Finished Shell

FIG. 2 Mean Shell

American Machinist

DIAMETERS OF SHELL BLANKS

inches high, 0.024 inch thick, metal before drawing 0.030 inch, thus going the limit on the practical use of the formula. Now we will calculate the cubic contents of metal before and after, to determine how much too long the shell would be.

It will not be necessary to take the bottom into account, as its volume remains the same in both cases; but, when the inside diameter is reduced in one or more operations, the metal taken from the bottom and drawn on the sides, is reduced in thickness if the metal is reduced in thickness in drawing. In this case, as said, we will not reduce the inside diameter.

The limit stated for the use of the formula gives this result:

$0.030 \times \frac{1}{5} = 0.006$ inch; $0.030 - 0.006 = 0.024$ inch,

as the metal thickness in the finished shell.

Consider the finished shell first:

Area of 4.048-inch circle = 12.8698 sq.in.
Area of 4-inch circle = 12.5664 sq.in.
Area of ring ..... = 0.3034 sq.in.
Volume of cylindrical ring,
$0.3034 \times 3 =$ 0.9102 cu.in.

Now consider the mean shell:

$$m = \frac{ht}{T} = \frac{3 \times 0.024}{0.030} = 2.4 \text{ inches.}$$

Area of 4.06-inch circle = 12.9462 sq.in.
Area of 4-inch circle = 12.5664 sq.in.
Area of ring ..... = 0.3798 sq.in.
Volume of cylindrical ring,
$0.3798 \times 2.4 =$ 0.9115 cu.in.
The difference in volume is,
$0.9115 - 0.9102 =$ 0.0013 cu.in.
The extra hight

$$\frac{0.0013}{0.3034} = 0.0043 \text{ inch,}$$

which is less than 1/200 of an inch on a shell 3 inches high.

Everyone who has drawn many shells knows that, if the drawing tools reduce the thickness of metal, they will not run any great length of time before the shell is reduced in length to a noticeable degree. On this account, and also the impossibility of drawing a shell to a uniform hight, it is only in rare cases that a shell is not edged after the drawing operations; especially long shells and, in most cases, short shells also.

I will not go into details on other shells as examples; only stating the amount the shell would be too long, as determined by the above method.

A shell 1-inch inside diameter, ¾ inch high, 0.010 inch thick, metal before drawing 0.012 inch, would be about 0.0032 inch too long. A shell 2 inches inside diameter, 1 inch high, 0.013 inch thick, metal before drawing 0.015 inch, would be about 0.0012 inch too long. A shell 3 inches inside diameter, ½ inch high, 0.250 inch thick, metal before drawing 0.252 inch, would be about 0.0029 inch too long. A shell 4 inches inside diameter, 3 inches high, 0.375 inch thick, metal before drawing 0.378 inch, would be about 0.0019 inch too long.

I have not taken into account the errors in the tools, varying hardness of metal, varying thickness of metal, stretch of the metal on the corner of the shell if it be of small radius; all these, and many others too numerous to mention, seem to work against us when we are trying to obtain accuracy.

I would suggest, if the reader intends using the formula, with or without the table, that he make a note beside it to the effect that it is approximate, and that the limit of use is $\frac{1}{5}T$, or $t = 0.8T$; or any other limit he may choose.

It now rests with the reader whether or not he will use the formula.

C. P. MACARTHUR.

Waterbury, Conn.

Getting a Job and Starting to Work

Mr. Godfrey a short time ago offered a good piece of advice to the man who is seeking a job and does not know how to ask for it. It is often the case that a good man is refused because he says too little about himself or needs too much

questioning as to his experience and is thought slow.

A mechanic after a job should use a little tact in presenting his case to a foreman, and realizing that foremen have other business to attend to, be as brief as possible, laying claim to all the skill he possesses and no more, and not waiting to be prompted for anything that helps a foreman to decide as to his ability to give satisfaction in any job that may be open.

It often happens that a man comes along and assures a foreman that he is well up on a particular job he knows is going and when he comes in to start makes a poor show, having entirely misunderstood the nature of the work and the quality expected.

A foreman I knew some years ago arranged things very satisfactorily. He used always to bring in a promising applicant, show to him the machine, class of work, explain the accuracy required, etc., and tell him he could take a trial if he thought himself up to it, with an intimation that he would surely "walk the plank" if not satisfactory.

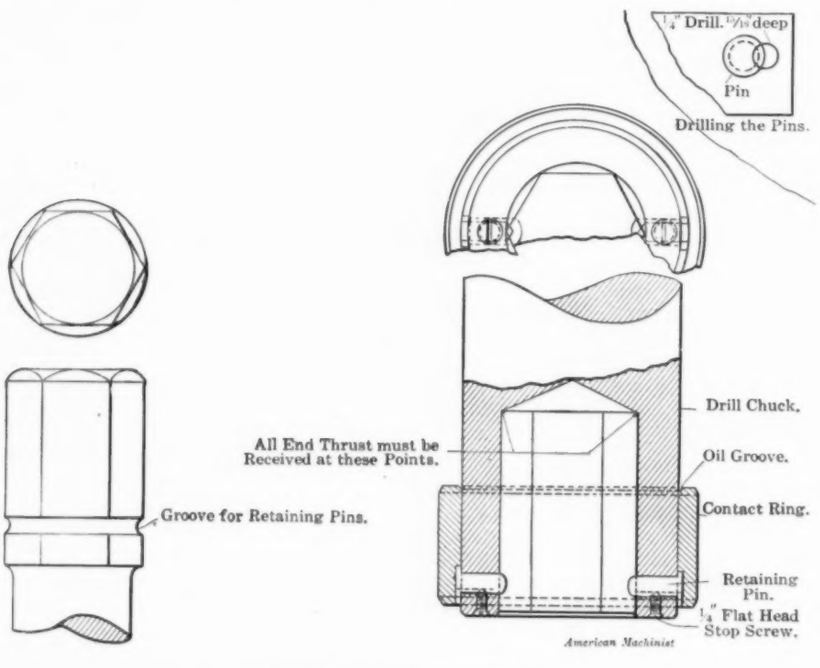
He had few failures, for when a man saw the work was out of his line, he either said so on the spot or failed to turn up at the time appointed and so saved himself the humiliation of being dismissed, and the foreman the trouble of performing an unpleasant duty.

Manchester, Eng. J. A. PARKER.

Hexagonal Drill Shanks and a Drill Chuck

On page 977, Volume 33, Part 2, S. B. Welcome suggests straight hexagon shank drills, as a solution of the drill-driving problem. We had about the same experience, and arrived at practically similar conclusions, some six years or so ago. Our trouble with the taper shank was the constant twisting off of the tangs, and, under heavy feeds, the drill so broken is sometimes difficult to get out of the drill-press spindle. The straight, round shank slips, is "chewed up" and caused to run out of true. Talk about the extra cost of milling hexagon shanks! How about the extra cost of turning down taper-shank drills, on which the tang has been twisted off, to the next smaller size, and milling a new tang? And how about the extra cost of truing up round-shank drills and removing the burs; and how about the then permanently weakened drill. And, last; no, not last, but the last in this sketch, how about the extra cost of chucks? Like Mr. Welcome, we had to find our own way out, and the greatest objection to our solution is that the collets must be changed as often as with the standard tapered and tanged collets. The accompanying cuts will be found plain, and the construction of the special drill chuck quite simple. As will be seen, our drills are milled, straight hexagon shanks, and grooved, as shown; our change collets are made in a similar manner. The chuck is one such as is regularly supplied with the drill press. We changed this to the inside hexagon shown, and drilled and counterbored the two holes for the retaining pins, which hold the drill and keep it from falling out. The flat-head screws keep the pins from coming out when the ring is raised to allow the drill to come out. The pins are grooved by being drilled in a cast-iron block, as shown in the inset sketch, Fig. 2. The slight head of the pins prevents them from going clear through the chuck. To operate, merely raise the ring, which runs loose, of course, with one hand, and insert the drill or collet with the other; to remove the drill or collet, raise the ring with one hand and catch the drill with the other as it drops out. Simple, isn't it? With this equipment you save all the time spent in stopping and starting the machine; you save drills, time and temper.

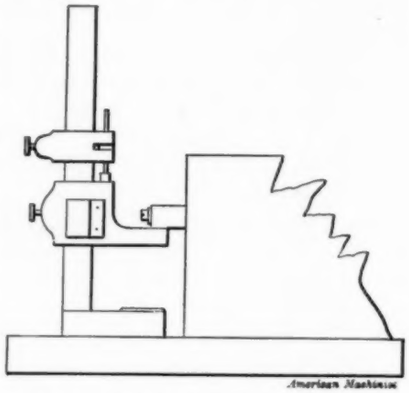
Buffalo, N. Y. S. J. CHIPMAN.



THE DRILL AND THE CHUCK

The Hight Gage and Accuracy

Referring to John Melville's article on page 1022, Volume 33, Part 2, under the above heading, it seems to me that the example chosen (setting a button) to illustrate the method of obtaining contact was rather unfortunate, as it presents an ideal case where the gage should be used, as in my sketch. When used thus, the contact takes place directly over the base, there being no tendency to tilt, as the gage is under compression when in contact and gives a most decided "feel," without the necessity of using blue as a marking. Those who have used the hight gage in this way on close work, will agree when I say that a ten-thousandth can be readily felt, this being much closer than the vernier scale can be read.



METHOD OF SETTING A BUTTON

I have used the extension and blue to establish contact as he describes, but never when possible to use the more reliable and quicker method.

With regard to his remark that the ratchet stop on micrometers has reduced the difference in "feel" to a minimum, I venture the opinion that the makers have considerately provided the ratchet stop merely as a fool-proof device, to prevent those who have not sufficient mechanical knowledge and skill to ignore it and who would ruin their mikes by putting excessive pressure on the screw, but among close-working mechanics who have to work consistently to a ten-thousandth, I have never met one who depended on the ratchet stop to secure accuracy.

G. RINDER.

Earlswood, Redhill, Eng.

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American Machinist

Some of the Ways in Which We Neglect Foreign Trade

There is probably more unwarranted pessimism afloat in regard to European business than on any other single subject in the machine-building trade today. Men who ought to know better are predicting that within five, or possibly ten years, all European business must disappear, owing to the increasing competition from machine builders in England and on the Continent, and that our only hope is in turning our attention to the South American countries.

As an indication of the way in which foreign trade is being cultivated by some builders, we quote from a German correspondent:

"I have just found an agent in Hamburg for an American firm, and they want me to find more in Austria and Hungary. Yet they are not willing to go to the trouble of going from their office to that of the steamship company, two blocks away, in order to give the agent prices on their goods laid down in Hamburg.

"When they buy from this side, they invariably demand prices laid down in New York. Dozens of other American firms are equally foolish, as they expect buyers to take all the trouble, and then in many cases demand payment in advance. German merchants quote prices laid down in Cleveland, Cincinnati, Chicago, or any other large point.

"Then, too, they are particularly careless in regard to sending advertising literature. I have just received a set of circulars relating to machinists' supplies in a very poor envelop, which was badly broken and the contents torn. These circulars were of five different sizes, and in an envelop altogether too large for even the largest circular. They were naturally received in very bad order and are not likely to be kept longer than it requires to glance them over and deposit them gently in the waste basket."

It is also interesting to quote from a letter written by an American engineer located in Russia, to a large firm who complained to him of a falling off in business with that country.

"You say that at one time you did a very large business in Russia and attribute the loss of it to the increase in duties. Unless that increase discriminated against America, it affected the European firms in the same way and obliged them to meet exactly the same conditions as yourselves. If they are able to surmount the obstacle, and you are not, it would seem to point to something wrong in your organization here.

"Wages in Europe have not decreased, nor have they increased in America to such an extent as to account for the wiping out of your business here. I have no doubt that, prior to the increase of duty, your prices were higher than those of competing continental firms. If so, then you sold here on merit, *plus* a little effort on the part of somebody. It is safe to assume that the standard of your goods has not fallen off, which only leaves the conclusion that the effort on the part of your representative is lacking.

"According to my way of thinking, as a result of observations, the firms at home must get busy here with active, Russian-speaking American salesmen. There must be plenty of Russians in America capable of doing such work, men who have been long enough in America to absorb American methods and ideas, but not long enough to have forgotten how business is done here.

"It is quite possible that the difficulties you mention do not really exist. Have you been here yourself and *seen* them, or are you merely judging from results, or from what somebody has told you? The fact that sales have fallen off does not prove that business cannot be done here. The host of English, French and German salesmen one meets here does not seem to indicate that those countries have much difficulty in doing business in Russia. The fact that in the two years I have been here I have never met an American salesman indicates to me that our firms are not *trying* to do business.

"A friend of mine here recently bought a small American kerosene engine to work his daily machinery. He is delighted with it, and particularly with the price. If the makers had a man on the spot, instead of relying on some agent in St. Petersburg, they could sell 500 such engines in six months, if what my friend says is only half true.

"I could go on giving instance after instance which all points to the same moral, and I hope that you may be able to find something in what I have written which will suggest ways and means to improve the situation here with regard to your machinery."

American manufacturers who want foreign business badly enough to go after it with half the energy of which they are capable, should study conditions in Europe personally, in the same way they would attack a similar problem at home. Everything indicates that it can be had if we go after it hard, and in the right way.

A World Trade Directory

The Bureau of Manufactures, at Washington, under authority of a special act of Congress, is about to publish an international trade directory, containing the names of approximately 125,000 business houses in foreign countries, which are engaged in foreign trade, including every line of industrial, commercial and financial activity. These names have been collected during the past four years by the United States consular officers and special agents. Because of the magnitude of the files, it was impossible to distribute the information to the business houses of the United States except through a special publication.

The book consists of pages 9x11½ inches in size and is to be bound in buckram. It is to be issued by the public printer through the Superintendent of Documents, at a price not to exceed $5 per copy.

As the names in this directory have been classified according to business, country and city, and as the consular officers and agents have made a very thorough canvass of the territories with which they are associated, the directory should be of great use to the business interests of our country.

PERSONALS

John J. Grant, of the Grant-Wood Manufacturing Company, Detroit, Mich., sailed on Feb. 8 for a short business trip abroad.

C. E. Brainard, formerly connected with the W. P. Davis Machine Company, Rochester, N. Y., has accepted a position with the Charles A. Strelinger Company, Detroit, Michigan.

Thomas Neal, formerly connected with the Acme White Lead Company, has been elected to the position of president of the General Motors Company, and will establish his office in Detroit.

Marlin D. Farnum, of the machine tool department, and Walter A. Dow, of the supply department of the Chandler & Farquhar Company, Boston, Mass., both of whom have been long identified with the sales department of this company, have recently been admitted to the corporation.

W. Van Ansdall has been appointed superintendent of the Jenney Electric Manufacturing Company, Anderson, Ind. Mr. Van Ansdall was formerly with the Triumph Electric Company, acting for a number of years as shop engineer and later in the capacity of assistant superintendent.

Lewis H. Morgan, who was for many years connected with the Pond Tool Company, subsequent to which he was superintendent and general manager of the Ridgeway Machine Tool Company, has recently been elected a member of the Institute of Mechanical Engineers, London. Mr. Morgan is now living retired in England.

W. H. McFadden, who has been closely identified with the rolling-mill industry for a number of years, has tendered his resignation as vice-president and general manager of Mackintosh, Hemphill & Co., Pittsburg, to take effect March 1, 1911, and will divide the next few months between looking after his important gas and oil interests and in traveling for his health.

George H. Wadsworth, for the past 15 years superintendent of the Falls Rivet and Machine Company, has resigned his position and will, after March 1, devote his entire time to the Wadsworth Core Machine and Equipment Company, of Akron, Ohio, he having purchased all machinery, patterns, tools and interest from the Falls Clutch and Machinery Company, successors to the Falls Rivet and Machine Company.

Stuart E. Freeman

The many friends of Stuart E. Freeman will learn with more than ordinary regret that, as the result of an automobile accident the evening of January 29, at Morristown, Philadelphia, he died the following Thursday, February 2.

According to the accounts that have reached us, the machine skidded on an icy pavement and dashed into a tree. Mr. Freeman walked to the nearest physician's office, a distance of two blocks, and back again, and then collapsed and was taken to a hospital, where he passed away after an interval of consciousness and was buried at East Mauch Chunk, Penn., February 4.

Mr. Freeman served his time at the works of the Dickson Manufacturing Company (now the Allis-Chalmers Company), Scranton, Penn. His remarkable mechanical judgment and executive capacity were recognized even before the expiration of his term, soon after which, if not before, he was placed in charge of the erection of one of the then note worthy pumping engines, designed by E. D. Leavitt and constructed at the Dickson works.

His later work included that of foreman for A. Falkenau, Philadelphia; superintendent for Todds & Stanley Mill Furnishing Company, St. Louis, Mo.; sales agent for the Sterling Boiler Company, at Atlanta, Ga., and superintendent for the Smith & Furbush Machine Company, of Philadelphia, which last position he occupied at the time of his death.

While in St. Louis the lure of the automobile, then in its infancy, attracted him, and he built a steam-power machine from his own designs. Steam was then in the lead as the propelling power for automobiles and, judged by the then state of the art, his machine was probably the best in existence. The engine was a positive gem, unequaled, perhaps, in any now existing steam machine, while the main constructive features of the car were far in advance of their time. The requisite capital could not, however, be obtained and the enterprise was abandoned.

It is, however, for his engaging personality and infectious good nature that his friends will remember him even more than for his mechanical accomplishments. He had a laugh that was contagious and from his presence the blues fled in dismay, while his brightness and quickness of repartee are seldom equaled. An inveterate practical joker, his fun never left a sting, while his never failing poise and self-possession would carry him through the most absurd situations of his own making with the solemnity of a monk.

Nor was this a surface matter only. During recent years he had to face the presence of a malady for which medical science knows but one end, and he faced it with a cheerfulness that was nothing less than heroic. Untimely as his taking off may seem, his friends may at least feel that it was a merciful alternative to a far worse end.

Mr. Freeman was twice married and leaves a wife and one son. His exact age is unknown to us, but it was about 43 or 44.

George W. Fifield

George W. Fifield, the well known lathe builder of Lowell, Mass., died on January 30.

Mr. Fifield was born in 1848 and took up the trade of machinist in the Manchester Locomotive Works, Manchester, N. H. For a number of years he found employment in and about Waltham, and in 1873 organized his own shop in Lowell, which later became the Fifield Tool Company. He specialized on engine lathes and for a number of years was rated as and for a number of years was rated as a possessor of considerable businessability.

Louis R. Alberger

Louis R. Alberger, president of the Alberger Condenser Company, New York City, died on Jan. 31.

Mr. Alberger was a native of Buffalo, N. Y., and after a course at Yale University, went into the manufacture of vacuum-process specialties in conjunction with his father. In 1887 he joined the organization of Henry R. Worthington, with which he severed his connection in 1901 in order to form the Alberger Condenser Company, with works at Newburgh, N. Y. As a separate concern, the Alberger Pump Company was formed, and under Mr. Alberger's guidance both companies attained success. Aside from engineering ability, Mr. Alberger possessed to a marked degree administrative and selling qualities.

The New Apprenticeship

By G. M. Basford *

An instructive paper presented at the Fourth Annual Conference of the Apprentice Instructors of the New York Central Lines.

*Assistant to president, American Locomotive Works.

Twenty years ago an apprentice boy entered a railway shop "down east." He was indentured and began his service with happy anticipation of the pleasure of learning the trade of machinist as many have done more recently. He worked six months "snagging" castings, gave up hope and quit. No one in the shop paid the slightest attention to him. No one thought of teaching him anything. He could not induce the foreman to put him on any work and he became discouraged. He would have been given other work in due time and probably would have become a workman forming one member of the vast army of those who have learned trades according to this method. Shops today are full of such workmen, and people say that apprenticeship is a failure. That kind of apprenticeship is, of course, a failure. It is worse, it is a crime. The company robbed the boy, not of money, for his pay envelop was not tampered with or his pocket picked, but he was promised an opportunity to learn a trade and was robbed of that in order that he should be used as cheap help. That, however, was not apprenticeship as we know it.

The following paragraph appears in the prospectus of the New York Electrial School, and is an example of remarks frequently made concerning apprenticeship which are true of much that passed for apprenticeship in the past. "The apprenticeship system under which young men formerly learned a profession or trade is a thing of the past. At its best, it was a crude way of imparting knowledge, long-drawn-out and tiresome alike to teacher and pupil, discouraging many of them before they had an opportunity of testing the system fairly."

This audience, however, represents a great movement, which is already national in its scope, dedicated to the proposition that the new apprenticeship is the only way to prepare young men for mechanical pursuits. Those who are in position to understand the results already attained are sure that we are right and that in the long run general acknowledgment of success will be accorded. If we carry out the work on its present lines we cannot fail and it will be surprising if we cannot improve upon them.

Advantage of Trade Instructors

Do you realize that the new apprenticeship contains two elements which the old never had? The first of these is the instructors, who are competent mechanics and who have nothing else to do. The second is mental development in school coincident with the shop development. Do you realize the advantage which you as instructors enjoy over the teachers in public schools and even over college professors? Your pupils have not only selected their callings, but they are actually following them, and they are holding their own and making their way among men earning their own living. This brings about an ideal relation between pupil and teacher, which does not exist in any other field of educational work. Other educators work with pupils who must make places for themselves after and because of the education. You educate workers in their work. There is a vast difference in these conditions, which is not understood by school men and others who argue that the trades should be taught in schools.

Closer to Pupils

The advantage which you enjoy over other teachers brings also a corresponding responsibility, for you must introduce methods specially adapted to the character of your problem. You are closer to your pupils than are any other teachers. This is the chief reason why you cannot use ordinary methods and ordinary textbooks. This is one reason why you need to be better teachers than seem to suffice for other conditions and other methods. Because you know very definitely what the boys need and because they use their knowledge as soon as it is given them, you stand in the best possible position as educators. This fact should in itself be an inspiration in the shop and in the class room. For example, consider the teacher of algebra in a public school. He teaches a subject without having the remotest idea of just how the pupil will be called upon to use it. The teacher's work in indefinite, unreal, separated from life, and is like a shot in the air. On the other hand, you educate a boy in laying out a boiler sheet, knowing that he will use the knowledge in order to hold his own in the shop. Is there not a vast difference between the two cases? It makes little difference how algebra is taught. It is, however, of the utmost importance that the boy should be taught the best way, the New York Central way, to lay out that boiler sheet, and he should know why it is the best way. He should also know that the slightest defect in this work involves trouble, delay, unnecessary expense and increased difficulty in the steps in the work which are to follow.

In the school room, because you know very definitely what the boys need, you are in position to educate them to think, which is an object difficult to attain in the indefinite work of the public school. It is certainly a privilege to teach under such favorable conditions, but you need to be the best teachers in the world, because you are responsible for preparing the American workman for his work. Remember that it will be easy to measure the results of your work and that they are sure to be measured.

Cultivating Industrial Intelligence

In a movement, such as that in which you are engaged, it is of the first importance to know in the most definite way what you are trying to accomplish. If you have never attempted to define the object of apprenticeship and cover the ground that you desire to cover in a few words, you probably do not realize the difficulty of doing so. The Commission on Industrial and Technical Education, reporting to the State of Massachusetts in 1906, stated the object of industrial education in the following words: "The Commission was told at almost every hearing that in many industries the processes of manufacture and construction are made more difficult and more expensive by a lack of skilled workmen. This lack is not chiefly a want of manual dexterity, though such a want is common, but a want of what may be called industrial intelligence. By this is meant mental power to see beyond the task which occupies the hands for the moment to the operations which have preceded and to those which will follow it; power to take in the whole process, knowledge of materials, ideas of cost, ideas of organization, business sense and a conscience which recognizes obligations."

Effect on Character

You are dealing with boys in the most impressionable age of their lives. They are at the age when the influence of home, of the church and of the public schools is likely to be weak and altogether wanting. The boys are, perhaps, away from home, but if at home they are drifting rapidly toward manhood and are forming the habits of their lives as to thought as well as in the occupations of their hands. They are about to establish their ideals and select companions whose influence is likely to last throughout their lives. In short, they are embyro citizens beginning to realize the independence which comes from earning their own liv-

ing. At this stage you are thrown in contact with them more closely than is any other human influence. You may impress them with your own personality, your own ideas, outlook and hopes, you may bring before them standards which they will adopt. You may not do any of these things.

Your influence depends very largely on your own personality, your knowledge of boys and boyhood and your ability to acquire close proximity to their lives. Perhaps you may realize the importance of this contact, but it seems reasonable to expect that if you can get upon such close footing with them that they will trust you with their troubles, ask your advice and take you into their confidence, you will be able to mold their future to a very large extent. Do you appreciate your responsibilities in this direction?

THINKING FOR YOURSELF

Nothing is to be feared from the influence of any man skilled with his hands and developed in his mind, for independent thought and action, but much is to be feared from a large class of workmen skilled or unskilled who allow others to think for them and who are normally weak in that they will not act with the courage of their own convictions. It seems to me that the greatest problem before the instructor of apprentices today lies in that part of the work which has to do with conscience and citizenship, and that in this direction lies the greatest opportunity for apprenticeship development. In this lies your greatest responsibility. If you do not realize it you fail to accomplish the greatest of all the objects lying before you.

A great deal may be accomplished through apprentice organizations, debating clubs, athletic teams and other influences which tend to develop individual initiative in connection with the teamwork idea. Boys need to manage something to develop self-government in order to realize that the world has a right to expect them to take their places in the human organization of life in general and in order that they may become self-reliant units in that organization.

Summing up, I would like to lay before you three facts: You are working under ideal conditions as to the relationship between instructor and pupil. This relationship renders it possible for you to exert most powerful influences over the character and the future of your students. The most vital object of this whole movement is to produce men, American workmen, skilled, resourceful, honorable men, men prepared and inclined to fulfil their obligations.

Using a trolley wheel 4 inches diameter in the groove, when an interuban electric car is running at 40 miles per hour, this trolley wheel is revolving at the rate of 3360 times per minute, or 56 times a second.

50 Years' in the Steam Pump Business

BY AN OLD TIMER

In the early part of the year 1848, a boy not quite 16 years old entered the little old wooden shop of Worthington & Baker as an apprentice to be "initiated (according to a letter from Mr. Worthington of that date) into the mysteries of pig and scrap."

The old shop was situated about 100 feet from the East river, on the line which divided Williamsburg from Brooklyn, and opposite the old navy yard "Block."

The firm name was Worthington & Baker. The shop was small, about 30x60 feet, and the capital that sustained it was not large enough to be a very tight fit.

The first job put in the hands of an apprentice was the scratching out of cores from the steam ports in the steam cylinders of the pumps as they came from the foundry. This exhilirating occupation worked as a damper on the ambition of the beginner, and was really more certain in its positive action than any of the automatic kind that have been invented since. But as most things or conditions that have a beginning have an end, so in due time, if the boy's patience and fingers held out, he was promoted to painting pumps, and after a few months, by an easy transition, elevated to the dignity of cutting bolts.

This kind of work was done with hand stocks and dies, the bolt being held in an old blacksmith's vise, having smooth jaws and a special reluctance to taking a firm grip. But a more deadly foe to youthful enthusiasm was the threading of the ⅝-inch steel rake rods by the same prehistoric process. The rods were not annealed, but had a blue glaze on the surface that was difficult to penetrate, and the dies delivered thin, hair-like threads of steel, which often found lodgment in the hands, preferably where the skin was thickest and extraction most difficult.

A dozen of these made a good two-week's job, and relieved the foreman of any further anxiety about that particular boy for the same length of time.

Later on, when work was given him on some old wreck of a lathe that left the chance open, the boy would start in on some little job of his own—calipers, squares, or a small steam engine, for instance. This brought about a condition of things that created the saying, "It took half his time to watch the foreman and half the foreman's time to watch him"—and it was tolerably true.

The foreman lived with his family in a couple of rooms over the shop and washed his face and hands once a week conscientiously. Anyhow such was the belief among the five or six boys and 20 odd men employed by the firm, and I never saw reason to doubt it.

William H. Baker, Mr. Worthington's partner, was a native of New England and an ingenious mechanic. He had received very little education in his youth, but was possessed of a vast fund of good judgment and common sense, and was always in poor health. He had industriously acquired every known form of disease, those of a pulmonary character being his favorites. It is believed that he would have lived to this day if he could have discovered a few kinds that were new and untried, to break the monotony of living.

His disposition was cranky, but at the very bottom his heart was kind and tender, so that in due time we all had a feeling of great regard for him.

One of the first lessons in securing accuracy and reliability ever received was from "Old Baker" in a manner that scared the apprentice out of a year's growth. The boy had just received his first four weeks' pay ($2.25 per week) and had got as far as the outer door with the plunder tucked in his vest pocket, when there was a peremptory call from "Old Baker" to come back.

"Here! Where's that money I gave you?"

Sure that he had committed a felony, the trembling lad returned and handed it over. Giving it back Baker ordered, "Count that money, boy."

He counted it in Baker's presence and found it to be correct. Meanwhile the others were waiting for their weekly pay and grinning at the boy's predicament—all of which piled up the agony of the situation.

"Now, young feller, don't you never take no money from no man without counting it in his sight, and don't pay any without making the other feller count it. I'm givin' you this first lesson for nothin', and it cost me thousands of dollars to learn it." Such was dear old Baker.

The friendship between him and Mr. Worthington was sincere and lifelong and their labors and studies and experiments together were already laying the foundations of an advance in the art of hydraulic engineering that later on was destined to challenge the attention of the whole world.

To remove paint from iron take lime and mix with common lye into a thick paste by the addition of water and apply over the surface with a mason's trowel to a thickness of about ⅛ in. After allowing the mixture to remain a short time, wash off with a hose and most of the old paint will be entirely removed, the remainder being easily scraped off. If the tank contains several coats of dried paint, two or three applications will be necessary before the entire surface is clean.

Shop Equipment News

ANY and all new or improved machines, tools or shop appliances of interest to men responsible for results in machinery-making plants will be briefly illustrated and described here — the machine shop news.
A more full and detailed description will be given — when it is real news — if it can appear here first — before it is sent to other papers. ALL descriptions appear in ALL four editions of the paper—Weekly, Monthly, Weekly English and Weekly German

An Adjustable Grindstone Truing Device

The halftone shows a grindstone truer manufactured by the Athol Machine Company, Athol, Mass. This device is

AN ADJUSTABLE GRINDSTONE-TRUING DEVICE

adjustable and can be used on any flanged-iron grindstone frame not over 14½ inches wide. The device will true the face perfectly, the water being turned on dust will not fly about the room.

Electric Shop Trucks

The accompanying halftone shows a storage-battery truck designed for shop use in the handling of packages, parts,

ELECTRIC SHOP TRUCK

etc., by the Lansden Company, Newark, N. J.

Three different styles of these trucks for industrial purposes, with varying load capacities, have been standardized by this company, the design of the carrying platform in each case being adapted for the special requirements of the particular duties imposed, such as railroad, steamship and dock service, and shop work.

The driving wheels are provided with the usual type of solid rubber tire, the steering wheel is spring-mounted, and by use of the Edison storage battery, these trucks are practically fool-proof.

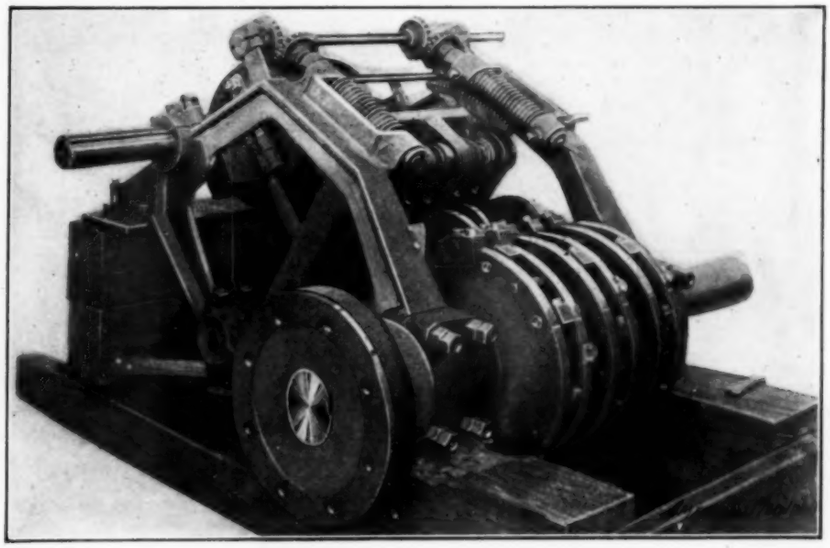
One type that seems well adapted to shop service has a speed of four miles an hour and is capable of carrying 5000 pounds.

Gearless Variable Speed Transmission

The accompanying halftone shows a new, variable-speed transmission device for gasolene, electric or other motors. The object of this invention is to provide any variation in speed, either forward or backward, while the driving motor continues to operate in the forward direction at a constant and most efficient speed, controlled by its own governor.

The principle upon which the device operates is that of a multiple friction pawl with wooden wedge blocks operating in grooved friction wheels. By employing several of these friction wheels with corresponding wedge blocks operated by crank arms at different angles, practical continuity of motion is said to be secured and, by varying the motion of the pawls through toggle levers, the speed of rotation of the friction wheels, and consequently of the drive, may be varied through a wide range.

There are no gears used in this device and backward motion is secured by a reversal of the wood-block friction pawls. The rights for this transmission are owned by the Fellows Transmission Company, Inc., Wilcox building, Los Angeles, California.

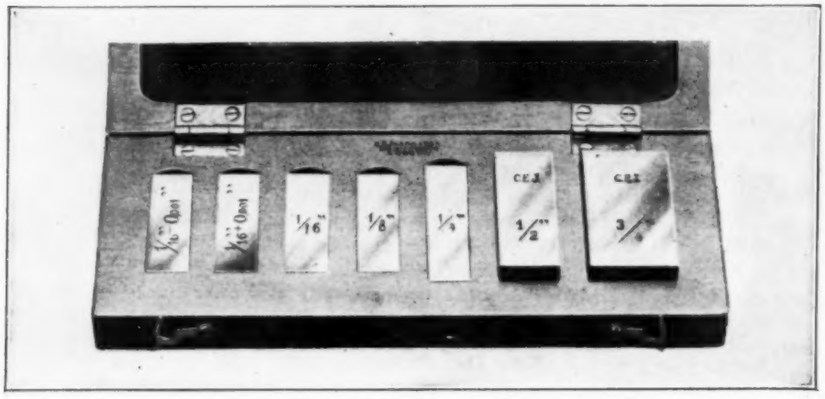


GEARLESS VARIABLE-SPEED TRANSMISSION FOR GASOLENE, ELECTRIC AND OTHER MOTORS

A Small Set of Swedish Gages

The halftone shows a new set of Johannson gages handled in this country by the Grönkvist Drill Chuck Company, 18 Morris street, Jersey City, N. J.

As shown it comprises seven separate gages but with it all sizes rising by sixteenths from 1/16 to 1 13/16 inches are obtainable; further all these sizes up to 1¾ inches with a plus or minus allowance of one thousandth can also be obtained, giving a total of over eighty separate gages.

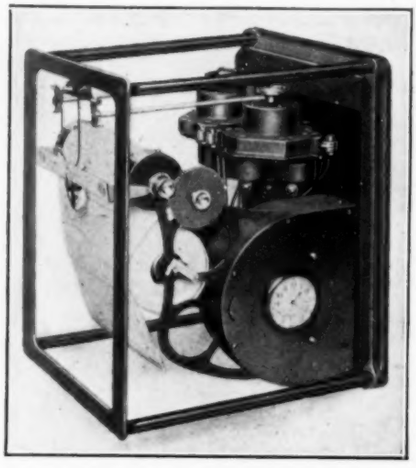


A Small Set of Swedish Gages

Recording Load Meter

In the accompanying illustration is shown a new recording electrical load meter, manufactured by the Sangamo Electric Company, Springfield, Ill.

The idea of this device is for the determination of a load factor, or proportion of full load placed upon electrically driven machines, such as machine tools, etc.



Recording Load Meter

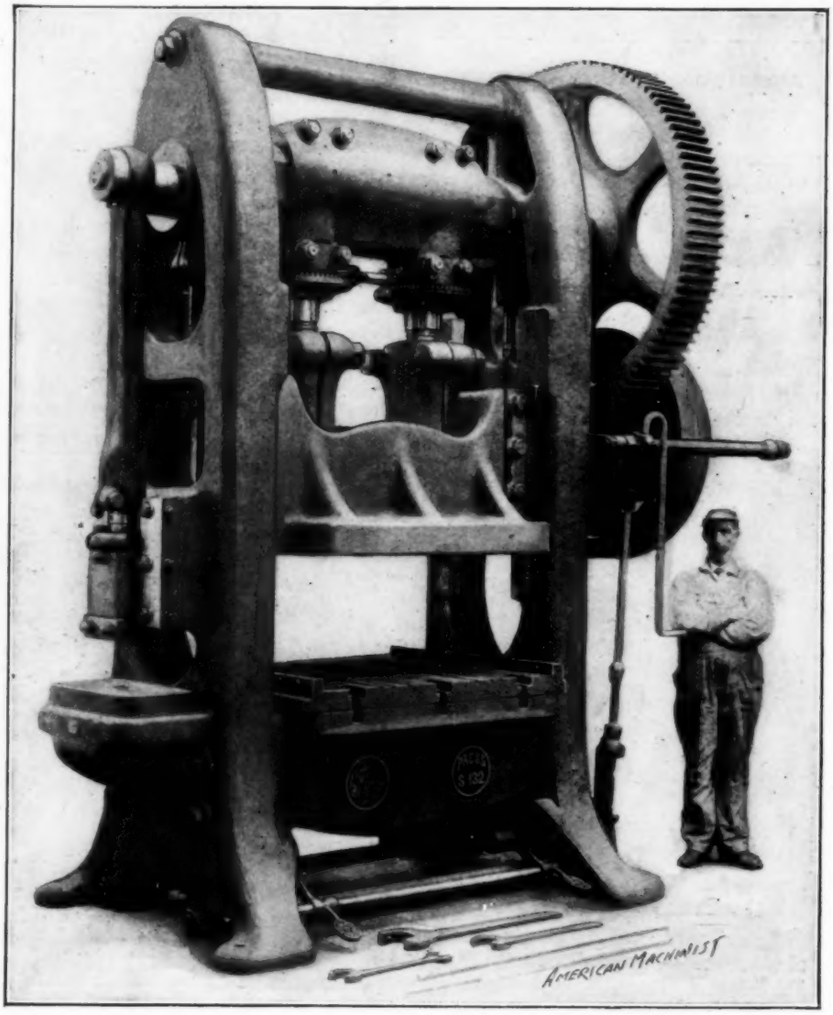
The instrument is constructed to draw a curve on a clock-operated strip of paper, so that the exact load for every minute of the day may be seen at a glance. It is claimed that by this means foremen and superintendents may, by applying this instrument to the different machine tools throughout the works for as long a period of time as desired, determine how constantly and how near its full capacity a machine tool is being operated. The advantage over the ordinary indicating wattmeter is that the latter gives only an instantaneous reading at any particular moment, and it is superior to the integrating wattmeter in that the latter shows only a total and gives no idea of load variation. The curve drawn on the chart shows every change of load throughout as long a time as may be thought necessary.

It is also claimed that by this means a check is had upon the operator when once the standard rating of the machine tool is determined from the performance of a first-class operator.

The construction of the instrument is said to be such that it is especially fitted for use by nonskilled persons.

A Heavy Ferracute Press

The Ferracute Machine Company, Bridgeton, N. J., has recently built the press shown. The press proper is designed to give a pressure of 200 tons. There is a side punch, having a stroke of 2 inches, which is convenient for punching and shearing while the main press is in operation. The shaft is a steel forging 9 inches diameter at the crank, the heavily trussed pitman strap acting as a reinforcement to it.



A Heavy Ferracute Press

The hight from bed to ram at top of stroke and adjustment is 22½ inches. The stroke of ram is 8 inches and its adjustment downward is 6 inches. The adjustment is accomplished by means of a ratchet, motion being given thereby simultaneously to the two pitman stems. The ratio of gearing is 7½ to 1, the large gear being 60 inches diameter and 8 inches face. The flywheel is 40 inches diameter and 7 inches face. The press contains a friction clutch, which enables the operator to start or stop the machine at any point of its stroke.

The distance between columns is 52 inches. A special plate or chuck is shown on the bed of the press. As ordinarily constructed, the bed is provided with a heavy, flat bolster-plate, clamps being furnished to fasten the lower dies to the plate. The total weight of the press is about 40,000 pounds.

The B. L. Ball Bearing

The halftones show a German ball bearing which is now being manufactured in this country by the B. L. Company, Norwich, Conn.

The ball bearings are made of chrome

FIG. 1. THE BEARING

steel throughout and are held down to very close limits, The balls are imported and are held to a limit of 0.0001 inch. The bearings are so designed that the entire space taken up between the balls by the retainer is equal to the space occupied by one ball only, thus allowing for a greater number of balls than usual where a retainer is employed.

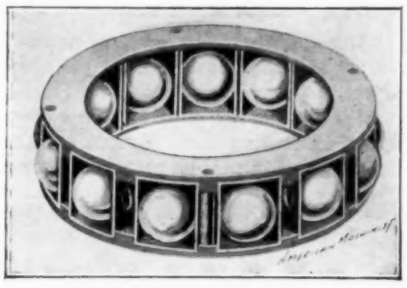


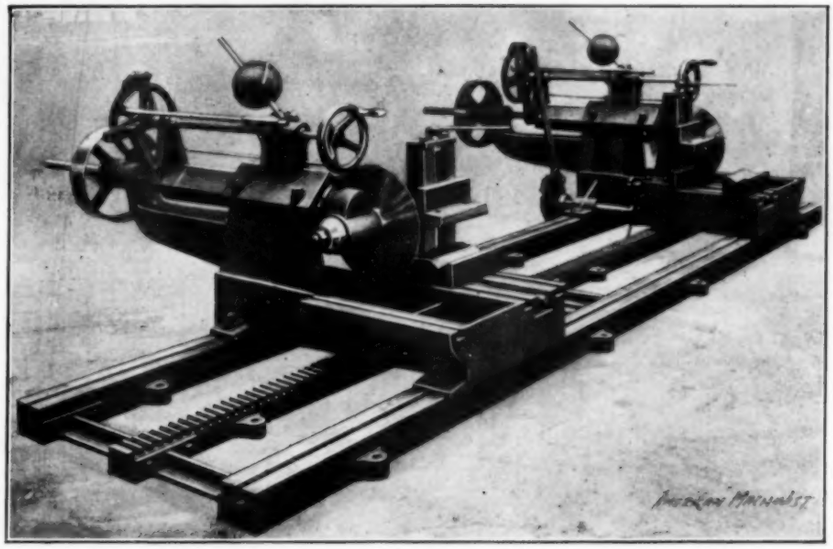
FIG. 2. THE RETAINER

Owing to a tendency of balls in radial bearings to crowd at certain parts and extend at other parts of the circle, the retainer is elastic, so that the balls may crowd or extend in a natural way, but not sufficient to allow them to touch one another.

Fig. 2 shows the retainer.

A Double Cold Sawing Machine

The halftone shows a machine built by the Gust. Wagner Maschinenfabrik Reutlingen, Germany. It is intended for trimming both ends of large steel girders at one cut. Both ends are entirely independent of each other, and can be set any distance apart on the bed. The saws are 16 inches in diameter each, driven by a four-horsepower motor belted to the pulleys at the left of each machine.



A DOUBLE COLD-SAWING MACHINE

Standard Drilling and Reaming Jig

The illustrations show a jig which is being put on the market by the Wood & Spencer Company, Cleveland, Ohio.

The lower member, as shown in Figs. 1 and 2, can be elevated. Work holders of various designs, to meet the requirements, fit the hole *C* in the lower member. Two of these are shown at *A* and *B*, Fig. 2.

The upper bushing is of the "slip" type. One of these is shown in place and one at the right in Fig. 1.

From the illustrations shown the method of operating this type of jig will be obvious.

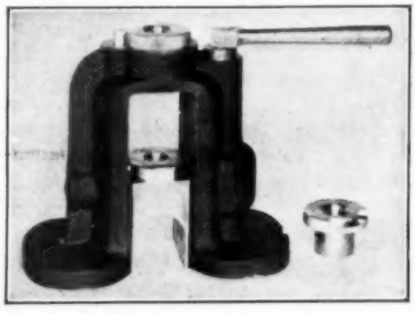


FIG. 1. A STANDARD DRILLING AND REAMING JIG

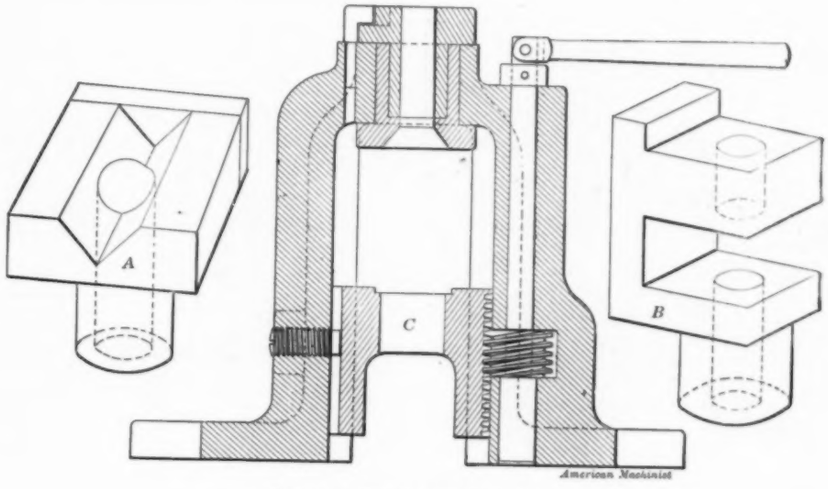


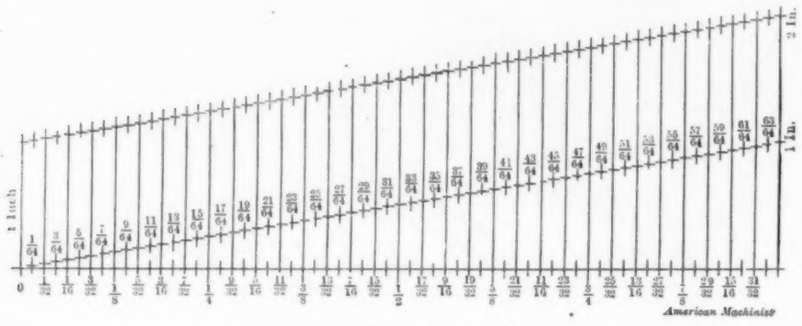
FIG. 2. DETAILS OF THE JIG

A Draftsman's Segregated Scale

The line cut shows a handy scale which is being put on the market by The Porter-Cable Machine Co., Syracuse, N. Y. The scale is intended as a convenience for quickly and accurately setting compasses and dividers to dimensions involving the use of the smaller fractions. It is furnished in two divisions, sixty-fourths and hundredths.

It will be seen that the scale is simply a table chart having a base line, and a series of short dashes beginning at zero and advancing by the unit of division up to the capacity of the scale, which in the present instance is two inches. Each dimension being separated from all others, it follows that it is just as easy to set the instrument at 57/64 or 1.93 inches as it is to 1/2 or 5/8 inch.

The scale is printed on bristol board and the base line is scored or depressed to form a groove into which the stationary leg of the compass will readily fall.



DRAFTSMAN'S SEGREGATED SCALE

Hydro-Pneumatic Pressure Blower and Vacuum Pump

The halftone, Fig. 1, is an interior view, and line cut, Fig. 2, an explanatory diagram of a new form of pressure blower and vacuum pump, now being manufactured by the Nash Engineering Company, of Brooklyn, N. Y.

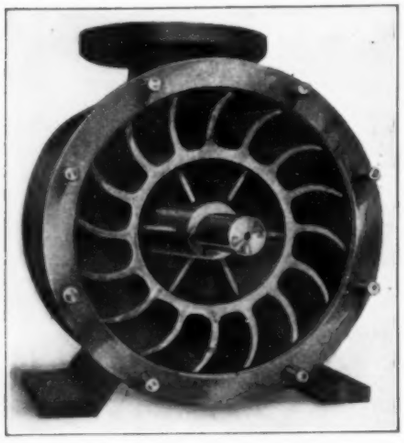


FIG. 1. NASH HYDRO-PNEUMATIC PRESSURE BLOWER

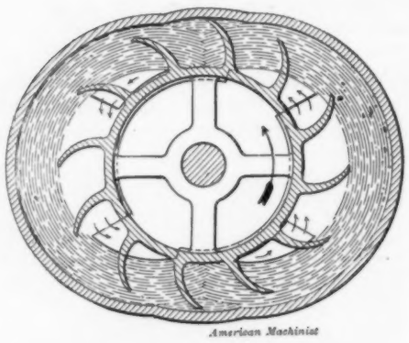


FIG. 2. PRINCIPLE OF NASH BLOWER

Referring to Fig. 2, it will be seen that an elliptical casing contains a rotor having curved blades, the outside diameter of which is very closely equal to the short diameter of the elliptical casing. Within this casing is a body of water which is caused to revolve by the action of the rotor blades. The high speed at which this water rotates produces sufficient centrifugal force to cause the water to follow the outer portion of the elliptical casing, as shown by the shading in Fig. 2.

Suitable ports are cast in the sides of the casing as shown by the small arrows in Fig. 2, so that, as the rotor and the water rotate, air is drawn in between the blades of the rotor and in the inner surface of the water, carried around and finally discharged from another set of ports in the casing walls.

By this means it is possible to make pressure blowers capable of compressing in a single stage to 20 pounds pressure, and in compound units to 40 pounds pressure. For the lower pressure, these pumps are listed for a maximum capacity of 600 cubic feet per minute, and for the higher pressure up to 60 cubic feet per minute. They also are suitable for any lower pressure and smaller capacity, 15 cubic feet per minute being the smallest listed.

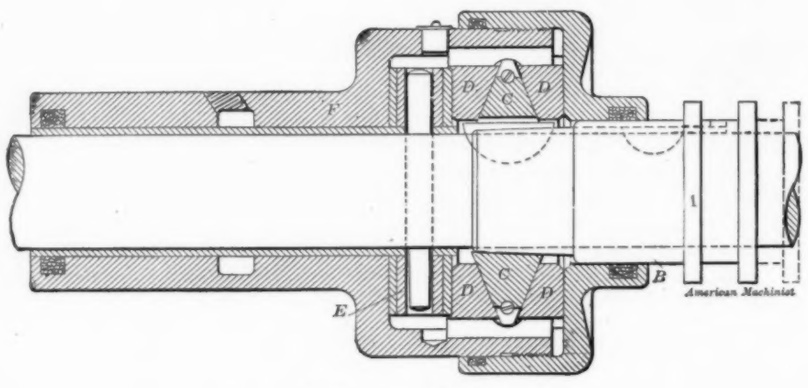
These machines are also applicable to vacuum work and are listed in sizes from 15 to 600 cubic feet per minute for from 15 to 25 inches vacuum in single units, and when duplex they are made for capacities from 30 to 130 cubic feet displacement per minute, and 29 inches vacuum.

It is claimed that, as the water forms all the joints, air leakages and wear of parts are practically eliminated. The pressures on the rotor are so arranged as to be balanced.

As the principle of these machines is based upon the impulse given to the water, the speed of rotation is comparable to that of water turbines, which makes them particularly suitable for direct connection to electric motors.

A Friction Clutch

The line cut shows a friction clutch which is being put on the market by A. S. Baldwin & Co., Sharon, Penn. This clutch is applicable to the driving of machine tools, automobiles, motor boats, etc. The clutch spool *A* actuates the wedges *B* which expand the sectional piece *C*. These force the members *D* apart exerting pressure on the frictional disks *E*, driving the member *F*.



A FRICTION CLUTCH

"Arts and Crafts Lamps," by John D. Adams, is a little book recently published by the Popular Mechanics Book Department, Chicago, and should interest those whose inclination leads them along this line as a pastime. The price is 25 cents.

Making a Large Spur Gear Pattern

By M. E. Hoag

While large gear patterns may not be uncommon nor of special interest in themselves, the one shown in Fig. 1 carries some special interest on account of the method used in building it, and for the excellent results obtained.

Fig. 1. The Finished Pattern

Fig. 2. Finishing the Teeth on a Disk Grinder

The gear shown is 75.2 inches pitch diameter, 1.25 diametral pitch, 94 teeth, and 8-inch face, and engages a 12-tooth shouldered pinion. This pattern was built by the Gardner Machine Company, of Beloit, Wis., for the Rock River Machine Company, of Janesville, Wis., and was made almost entirely on a Gardner patternmaker's disk grinder. The only other machine or hand work was sawing out the stock, turning up the inside of the rim, and shaving the rounds on the spokes, hub and rim.

In building the pattern the hub, coreprint, spokes and rim sections were finished ready to glue up on the disk grinder.

The teeth were of "single-curve" layout, and the method of making them is shown in Fig. 2. The wooden form *A*, Fig. 2, was made as shown in Fig. 3. The two holes *B B* in the base fitting a pin in the plate *C*, Fig. 2, which was adjusted the right distance from the disk to give the proper radius for the generating circle, in this case 9.4 inches, and the table was tapped to give a slight draft.

The tooth blanks were secured to the piece *A* with screws, and one side generated, after which they were reversed and the other side finished. The surface obtained on the disk grinder was so smooth and perfect that only a very slight draft was required, 1/64 inch being found sufficient.

The pinion was made in practically the same way, except that it was finished *entirely* on the disk grinder.

Though the "single-curve" tooth may not be correct in theory, it proved practically correct in this case, as Mr. Fink, of the Rock River Machine Company, considers it the smoothest-running cast gear he has ever put on a machine.

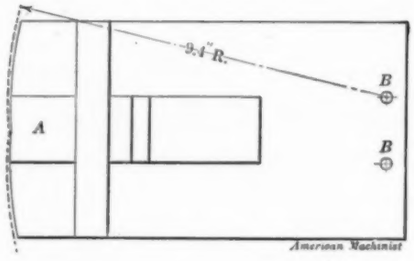


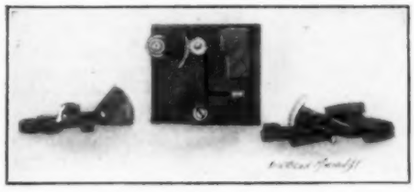
Fig. 3. Laying Out for the Wooden Form

Gear and Pinion Test Gage

By J. Knox

In a large automobile plant with which I am identified the gear- and pinion-test gage, shown in the accompanying cuts, was designed.

A Bath indicator was dismounted from its holder and mounted upon an angle plate. Against the working point of this indicator the boss of a lever was placed with its fulcrum near the bottom, with an adjustable tension spring attached to this lever in such a manner as to enable the operator to delicately adjust the movement of the lever to a nicety between the adjusting spring and the indicator spring, so that the sector to be tested will mesh in with the master pinion with scarcely any friction. A tooth that was 0.001 large on the pitch circle would not be 0.001 large on its pitch diameter and for this reason a larger limit of error was permissible, as shown by the indicator needle. For testing the pinions which mesh with the sectors we made a master sector, as shown in the cut. Owing to the liability of distorting the teeth in hardening, both masters were left soft, and we find we were justified in doing so, as the wear on them is almost negligible.



Gear- and Pinion-test Gage

This design makes a complete and satisfactory outfit at small cost.

Drilling a Hole Half in One Piece and Half in Another

This is sometimes hard to do, but can easily be accomplished in the following manner. Put the pieces to be drilled, one at a time, in the shaper and with a V-shaped tool just mark the work along the center line the drill is to follow. When the work is put together there is a very small hole for the center for the drill to follow. By using a small drill first to widen out the hole, subsequently drills can be easily held to the course they are desired to follow.

Increasing Shop Capacities

News items for the sales department — where more equipment will be needed. Authentic news is solicited for this department, not rumors or gossip — facts

METAL WORKING

NEW ENGLAND

The Woonsocket (R. I.) Machine and Press Company has awarded contract for the erection of a four-story and a one-story addition.

The Baird Machine Company, of Oakville, Conn., has decided to locate in Stratford, Conn., and work will shortly be commenced on a $100,000 plant.

The Emerson Manufacturing Company, Lawrence, Mass., has taken out a permit for an addition to its machine and carpenter shop, at 353 Market street.

Beaudry & Co., Inc., 141 Milk street, Boston, Mass., building power hammers, will establish new shops and will need new equipment, including planers, lathes, milling machines, drills, etc.

MIDDLE STATES

The Macomb (Ill.) Sheet Metal Works has purchased site for a new plant.

The Union Rolling Mill Company, Cleveland, Ohio, will erect a new mill.

The Columbia Metal Stamping Company, Cleveland, Ohio, is enlarging its plant.

J. J. Sullivan will erect a garage at 2047 Rittenhouse street, Philadelphia, Penn.

The Dockray Brass and Iron Company, Zanesville, Ohio, will buy some new machine tools.

The John M. Lauer Machine Company, Detroit, Mich., will erect an addition to its plant.

The Bottomby Machine Company, Alliance, Ohio, will erect a new plant on Patterson street.

The plant of the Aluminum Goods Company, Manitowoc, Wis., will be greatly enlarged.

Garage will be built at Moreland street and Martin's lane, Philadelphia, Penn., for W. J. Gruhler.

The Sterling Wire Box Company, Indianapolis, Ind., had a fire at its plant; $8000 damages.

The International Steel and Iron Construction Company, Evansville, Ind., will erect a new plant.

The Grosneckle grille and screen factory, of North Manchester, Ind., was burned with a loss of $10,000.

The Indianapolis Drop Forge Company will spend about $20,000 for improvements that include new boilers.

The International Time Recording Company, Endicott, N. Y., will build a three-story addition to its plant.

The Trussed Concrete Steel Company, Youngstown, Ohio, will rebuild the lath department, recently burned.

Joseph Fahys & Co., Sag Harbor, L. I., manufacturing watch cases and silverware, will erect a large addition.

It is reported the Newburgh (N. Y.) Ice Machine Company is looking for another site on which to erect a new plant.

The J. M. Jones Car Works Company, Watervliet, N. Y., has incorporated and will build an addition to its plant.

The Case Crane Company, Columbus, Ohio, is planning for the extension of its shops to take care of increased business.

The Gem Manufacturing Company, Bellefontaine, Ohio, making churns, etc., is looking for suitable site for a new plant.

The Toledo (Ohio) Nickel Works has moved into new quarters at 17 St. Clair street, and will install additional equipment.

Plans have been completed by Savery, Sheets & Savery for a three-story garage for Strawbridge & Clothier, Philadelphia, Penn.

The Kelly Foundry Company, Elkhart, Ind., has been incorporated with a capital of $10,000 by A. Sorge, Jr., I. Kelly and Edward Kelly.

Geo. A. Otis Company, manufacturers of mattresses, bed springs, etc., at Buffalo, N. Y., will erect a new two-story factory on Florida street.

The Standard Manufacturing Company, Pittsburg, Penn., manufacturing plumbers' supplies, will locate a branch plant in Toledo, Ohio.

The McFarland Foundry and Machine Company, Trenton, N. J., is in the market for a brass-melting oil furnace of from 300 to 500 pounds capacity.

A large machine shop will be erected at the new plant of the Diamond Alkali Company, at Fairport, Ohio M. Wludecker, superintendent, Painesvile, Ohio.

Bertsch & Co., Cambridge City, Ind., is looking for a location for new machine shop and foundry. The company manufactures punches, shears, bending rolls.

The Universal Manufacturing Company, Freeport, Penn., has been incorporated with a capital of $100,000 to manufacture enamel ironware. J. C. Stevick is president.

The Brooklyn Tool Company, Brooklyn, Ind., has been incorporated with a capital of $10,000 by J. S. Spoor, H. T. Blake and Iola Spoor, to conduct a manufacturing business.

The New Process Foundry Company, Canton, Ohio, is looking for another location and may go to Toledo. The product of the company is iron radiators and boilers for heating.

Edson Van Steenberg, Bellefontaine, Ohio, is planning to incorporate a company for the manufacture of a churn, which he invented, and has been making on a small scale.

The Arcade Garage and Machine Company, Bloomfield, N. J., has been incorporated to operate garage, etc. Capital, $10,000. Incorporators, H. H. Samuel, O. E. Wolf, L. W. Samuel.

The Lewis Welding and Manufacturing Company, 234 Cherry street, Toledo, Ohio, will increase the capacity of its plant. The concern manufactures motor parts and special valves.

The Weber Gas Generator Company, Buffalo, N. Y., has been incorporated to manufacture gas valves, meters, generators, etc. Capital, $200,000. Incorporators, M. Regan, E. Weber, D. Hyman.

The Busch-Sulzer-Diesel Engine Company, St. Louis, Mo., recently incorporated, will build a $1,000,000 plant for the manufacture of the Diesel oil engine. Adolphus Busch is president.

The Steel Ball Company of America, New York, has been incorporated with $100,000 capital to manufacture balls and bearings. Incorporators, R. A. Martin, E. M. Long, A. E. Dadula.

The Nye Gas Machine Company, Laporte, Ind., has been incorporated with a capital of $75,000 by J. R. Nye, H. B. Johnston and C. F. Peterson, to manufacture gas engines and appliances.

The Gary (Ind.) Screw and Bolt Company, which is a subsidiary of the Pittsburg Screw and Bolt Company, has plans ready for the erection of a plant, which will cost about $1,000,000.

The Dowling-Schultz Hardware Company, Danville, Ill., has been incorporated with $20,000 capital to manufacture and deal in hardware, cutlery, etc. Incorporators, O. R. Schultz, E. L. Dowling, etc.

The W. A. Wood Auto Company, with a factory at Kingston, N. Y., has completed financial arrangements, and is about to install a considerable amount of machinery for the manufacture of auto trucks.

The Arch City Foundry Company, Columbus, Ohio, has been incorporated with $10,000 capital to manufacture all kinds of metal castings and stampings, by W. H. Jones, R. W. McCoy, N. F. Ustick, etc.

J. M. Jones Sons Company, Watervliet, N. Y., has been organized to manufacture railroad cars and motor vehicles, repairing, etc. Capital, $100,000. Incorporators, J. H. Jones, J. B. McLeese, F. R. Jones.

The Bremen Manufacturing Company, Bremen, Ohio, has been formed with $50,000 capital to manufacture hot-air pumping engines and pressure tanks, by A. F. Turner, J. E. Purvis, H. M. Shelhamer, etc.

The Hampshire Arms Motor Company, Brooklyn, N. Y., has been organized to maintain garage, etc. Capital, $10,000. Incorporators, Andrew Schmitt, Jr., 118 Avenue P; Wm. H. Manz, 414 Stuyvesant avenue, etc.

Williamson Brothers, of Philadelphia, Penn., have secured control of the American Ship Windlass Company, of Providence, R. I., and expect to make extensive additions. The product is engines, pumps, windlasses, stokers, etc.

The Valle Kimes Company, Dayton, Ohio, has been organized to manufacture all kinds of hydraulic, electrical and pneumatic machinery. Incorporators, J. Henry Valle, Hugh W. Kimes, Claude E. Burnett, etc. Capital, $100,000.

The Newcomb-Carburetor Company, Harrison, N. Y., has been organized to manufacture carbureters, gas-engine supplies, etc. Capital, $100,000. Incorporators, E. C. Newcomb, North Scituate, Mass.; E. C. Chamberlain, New York; G. F. Chamberlain, Harrison.

The New York, Ontario & Western Railroad has issued a list of machine tools and equipment for blacksmith shop, which will involve an expenditure of about $50,000. The list was prepared by D. P. Flory, superintendent of motive power, Middletown, N. Y.

C. A. Draper, 56 Beaver street, New York, is general purchasing agent.

SOUTHERN STATES

The Morris Iron Company, Frederick, Md., will enlarge its plant. Will be equipped with motor drive.

Plant for the Birmingham (Ala.) Horseshoe and Rolling Mills Company is now being erected and will be rushed to completion. D. A. Jacoby is president.

The Central Motor Company, Huntington, W. Va., has been incorporated to conduct a garage. Capital, $10,000. Incorporators, C. H. Day, W. R. Kyger, L. A. Day, etc.

The Reeves Bolt Company, Macon, Ga., has recently incorporated with $10,000 for the purpose of manufacturing a new bolt. F. Bartow, C. M. Stubbs and others, are incorporators.

The Auto Car Company, Wheeling, W. Va., has been organized with a capital of $10,000 by E. S. Romine, J. P. Arbenz, E. F. Horstmann and others, to manufacture and deal in automobiles and aëroplanes.

The W. H. Gillette Manufacturing Company, Louisville, Ky., has been incorporated with $100,000 capital to manufacture buggy, wagon and automobile equipments. Incorporators, W. H. & W. L. Gillette, C. H. Lambert.

WEST OF THE MISSISSIPPI

The Fulton Iron Works, St. Louis, Mo., will erect a $350,000 plant.

The Duo Hay Press Company, of Wichita, Kan., is seeking suitable site for a new plant.

The Producers Oil Company will rebuild machine shops recently destroyed by fire, at Humble, Tex.

Contract has been let for the construction of a new plant at Tulsa, Okla., for the Queen Bee Stove Company.

The Wichita Falls (Tex.) Boiler Manufacturing Company is said to be considering the removal of its plant.

The Grays Harbor Iron Works, Hoquiam, Wash., will build an addition to its plant and install new machinery.

The Standard Screen Manufacturing Company, Los Angeles, Cal., is having plans prepared for a new factory building.

T. D. Dinneen, Portland, Ore., will build a commercial garage and repair station. Modern repair equipment will be installed.

The machine shops of the Utah Coalition Mines Company, at Alta, near Salt Lake City, Utah, were demolished by a snowslide.

The Pacific Sash-Weight Foundry, recently incorporated at Los Angeles, Cal., has taken out a permit to erect a foundry building.

The Wauna Land Company, Portland, Ore., will erect a two-story commercial garage. Modern repair machinery will be installed.

The Los Angeles Can Company, Los Angeles, Cal., is having plans prepared for a new factory building to cost about $20,000.

Swan & Swing, San Bernardino, Cal., will build a commercial garage to cost about $8000. Modern repair equipment will be installed.

L. Clotfelter, McKittrick, Cal., is having plans prepared for a commercial garage and repair shop. Repair machinery will be installed.

The Pearson Company, El Paso, Texas, is asking for bids for a new foundry, roundhouse and railroad shop, to be built for a local road.

The Holt Manufacturing Company is to install additional machinery in its plant at Walla Walla, Wash. The company builds traction engines.

The Cramp & Cameron Automobile Agency, Los Angeles, Cal., will build a commercial garage at Rialto, Cal. Modern repair machinery will be installed.

Wm. Reidt, Portland, Ore., will build a steam-laundry plant to cost $24,000. He is also contemplating the erection of a commercial garage and repair shop.

The Sherman Machine and Iron Company, Oklahoma City, Okla., will erect several new buildings, including foundry, machine shop, boiler shop, woodworking shop, etc.

The Coin Machine Manufacturing Company, Portland, Ore., will build a new plant on Grand avenue. Modern machinery will be installed. About $40,000 will be expended.

The Brown-Lewis Company, Walla Walla, Wash., manufacturers of agricultural machinery, will enlarge the capacity of its plant. A new foundry and assembling shop will be included.

American Cattle Guard Company, New Orleans, incorporated recently with $100,000 capital stock, will install an equipment of molding and stamping machinery to manufacture railway cattle guards.

The recently incorporated Warman Steel Casting Company, Los Angeles, Cal., will immediately start the erection of a vanadium crucible foundry in the vicinity of this city; a site at Redondo, Cal., is being considered. All equipment necessary for a steel-casting foundry plant will be installed. G. B. & N. M. Warman, foundrymen, Columbus, Ohio, are interested in this project.

CANADA

The Montreal Harbor Commission will equip large new repair shops at Montreal.

The Page-Hersey Iron and Steel Tube Company, of Welland, Ont., will erect an addition to its plant in the spring.

The Electro Metals Company contemplates the erection of a new mill at Welland, Ont., which will double its output.

GENERAL MANUFACTURING

NEW ENGLAND

Geo. C. Vaughn will erect a leather factory at Salem, Mass.

The M. S. Comb Company, Providence, R. I., will erect an addition.

The Paradise Rubber Company, of Boston, Mass., is to locate in Hyde Park, Mass.

The Windsor Print Works, North Adams, Mass., will install a system of motor drives.

The Collins-Plass Company, Fall River, Mass., will erect an addition to its bag plant.

The factory of the New England Trunk Company, at Everett, Mass., was destroyed by fire.

Bobbin factory of Benjamin Wilbur, at South Scituate, R. I., was destroyed by fire. Loss, $15,000.

The plant of the Converse Independent Rubber Company, at Malden, Mass., was burned. Loss, $200,000.

The New York, New Haven & Hartford Railroad will erect an addition to its power station at Coscob, Conn.

The Ideal Switch Company, Plainville, Conn., manufacturers of electrical specialties, will erect a new factory.

A new 50-kilowatt engine and generator will be required for the new municipal building, at New Bedford, Mass.

The Dwyer-Mortimer Shoe Company, Pittsfield, Mass., is considering the removal of its plant to some other locality.

H. E. Reed is planning to erect a plant at Stamford, Conn., for the manufacture of dye woods, chemicals, extracts, etc.

The New England Telephone and Telegraph Company, Worcester, Mass., makes announcement that it has plans under way for either a large addition or a new plant.

The new dye house of the Jos. Benn & Co., Inc., Greystone, R. I., is nearing completion. New machinery will be installed. The old dye house is to be remodeled into a two-story factory.

MIDDLE STATES

A. L. Rea, Zanesville, Ohio, will build a new laundry.

Olean, N. Y., is considering the question of a municipal lighting plant.

Point Pleasant, N. J., is considering plans for a municipal waterworks.

The Wm. Peter Brewing Company, Union Hill, N. J., will enlarge its plant.

Fire damaged the picking room of Hatheway & Reynolds' mills, Oriskany, N. Y.

The Olympian Knit Goods Company will enlarge its plant at New Hartford, N. Y.

The Forest City Woolen Mills, Dresden, Ohio, will increase the capacity of its plant.

The M. & M. Rubber Cement Company, Akron, Ohio, will erect two additional buildings.

It is reported the Elizabeth (N. J.) Ice Company will erect a new 150-ton ice plant.

The M. Werk Soap Company, Cincinnati, Ohio, is contemplating an addition to its plant.

The Bernardino Bottle Cap Company, Evansville, Ind., will install a new boiler and engine.

The John H. Kintle Company will erect a large malt house on Burnham street, Milwaukee, Wis.

Runkel Brothers, chocolate and cocoa manufacturers, of New York, will erect a factory at Elizabeth, N. J.

The plant of the Consolidated Woolen Felt Mills, Amsterdam, N. Y., was destroyed by fire. Loss, $120,000.

The Snyder Manufacturing Company, Wapakoneta, Ohio, will rebuild its furniture factory recently burned.

Cleveland, Ohio, contemplates the erection of a municipal light, heat and power plant. A. B. Lee, city solicitor.

The White Swan Laundry Company, Evansville, Ind., is planning to build an addition doubling the size of its plant.

The Evansville (Ind.) Pure Milk Company will erect an addition and install new boiler and refrigerating machinery.

The Chamber of Commerce, of Kingston, N. Y., is reported to have about induced a company to build a paper mill there.

The board of trade, of Washington, Penn., is negotiating with the American Keg and Barrel Company to establish a plant there.

The Knightstown (Ind.) Ice Company has been organized for the purpose of manufacturing ice. Capital, $12,000. Incorporators, P. W. Gilbreath, M. T. Gilbreath, A. A. McCray.

Fire destroyed a large portion of the plant of the Barrett Manufacturing Company, Philadelphia, Penn., manufacturing coal-tar products.

The Michigan Ladder Company, of Ypsilanti, Mich., will construct additional buildings to enlarge its plant, expecting to double its output.

The Barry Electric Light and Power Company has been incorporated at Barry, Ill. The company will build a plant and sell light and power.

The Park Furniture Company, Rushville, Ind., has let the contract for an addition to its plant. The new building will be two stories high.

The Harbauer-Maclean Company, Toledo, Ohio, manufacturing catsup, vinegar, pickles, etc., will establish a branch plant at Maumee, Ohio.

The Republic Window Glass Company, Maumee, Ohio, has been organized with $15,000 capital by Myron L. Case, S. R. Case, J. W. Underwood, etc.

The United Gas and Electric Company, Jeffersonville, Ind., has announced that it will expend nearly $30,000 in further improvements and extensions.

The Barker-Brown Shoe Company, Huntington, Ind., has announced that it will begin work at once on a large three-story additional factory building.

The Sillocks-Miller Company, South Orange, N. J., manufacturing artificial leather specialties, celluloid articles, etc., is erecting a new factory and power house.

The Grasselli Chemical Company, of Chicago, has appropriated $150,000 for improving and enlarging its plant at Hammond. Two new buildings will be erected.

Callahan & Myers will erect a new shoe factory at the corner of Fourteenth and Liberty streets, Allentown, Penn. Company is now located at Franklin and South streets.

The Allentown Spinning Company has awarded contract for the erection of a $70,000 mill at Erie railroad and South Second street, Lakeview, N. J., to be used for spinning flax.

The U. S. Hygienic Ice Company, Brooklyn, N. Y., has been incorporated to manufacture and deal in artificial and natural ice. Capital, $150,000. Incorporators, G. F. Martin, E. J. Forhan, H. P. Jones, New York.

The United States Gypsum Company, which has two mills at Oakfield, N. Y., has purchased additional property at Oakfield, and will construct a new plant. After it is in operation the old plants will be abandoned.

The Youngstown Lumber Company, Youngstown, Ohio, has been incorporated to manufacture and sell lumber and builders' supplies. Incorporators, Thomas B. VanAlstine, J. E. Bert, Charles Koonce, Jr., etc. Capital, $50,000.

The American Lime Company, of Chicago, place of operation, in Harrison county, Ind., has been incorporated with a capital stock of $200,000 by J. B. Graham, Jacob Eichel and B. L. McNulty, to quarry and crush stone, and furnish all lime products.

SOUTHERN STATES

The Virginia Mills, Suffolk, Va., will double the capacity of its power plant.

New boilers will be installed at the plant of the Morris Iron Company, Frederick, Md.

The American Cement Tile Manufacturing Company has commenced the erection of a plant at Corey, Ala.

The Norfolk & Portsmouth Traction Company is making preparations to erect a new boiler house at Suffolk, Va.

The plant of the Crescent Felt Mattress Company, New Orleans, La., was burned. Loss, $15,000. Will be rebuilt.

D. W. Alderman & Son Company, Alcolu, S. C., has plans for rebuilding its recently burned sawmill; new building will be two and one-half stories high.

The Haskew Lumber Company, of South Pittsburg, Tenn., is building an addition to double its present capacity. Will add new boilers and woodworking machinery.

W. T. Lang, formerly president of the Lang Manufacturing Company, West Point, Ga., has organized the Castle Cotton Mills, Ltd., Monticello, Ga., with $1,000,000 capital. One of the largest plants in the south will be erected.

The T. E. Lindsey Manufacturing Company, Jackson, Tenn., a new concern, capitalized at $15,000, will erect a plant for the manufacture of bank, office, church furniture, etc. T. E. Lindsey, of Jackson, is the principal stockholder.

WEST OF THE MISSISSIPPI

Kirkville, Mo., is considering the establishment of a lighting plant.

The city of Willamette, Ore., will install a complete system of waterworks.

The M. E. Phelps Lumber Company, Cusick, Wash., is building a new sawmill.

The city of Redmond, Ore., will install a new water system to cost $10,000.

The company is installing new equipment in its substation at Kennewick, Wash.

W. E. Ford & Co., Lewiston, Idaho, will build a new sawmill and planing mill.

The St. Helen Lumber Company, St. Helen, Ore., is building a new sawmill plant.

The Hope Lumber Company, Hope, Idaho, is contemplating the erection of a sawmill.

The Schallinger Produce Company, Spokane, Wash., will build a new plant in 1911.

C. R. Wade, Brandon, Ore., is at the head of an enterprise to build a canning factory.

Mr. Flanders, Modesto, Cal., is planning for the erection of a planing mill at Lawndale.

The Glendora Irrigating Company, Glendora, Cal., will install new pumping equipment.

The city council, Humeston, Iowa, is considering the question of a new electric-light plant.

C. C. Murray & Sons, Madisonville, Tex., have secured franchise for an electric-light plant.

The Canyon Lumber Company, Everett, Wash., is installing new equipment at its plant.

The Rex Spray Company, Wenatchee, Wash., will build a plant for the manufacture of barrels.

The Pacific Match Company, Tacoma, Wash., will build a new factory in this vicinity.

The McMurtry Manufacturing Company, Denver, Colo., will erect a new $45,000 paint factory.

The Lucklamute Valley Flouring Mills, Monmouth, Ore., will build an addition to its plant.

The G. F. Deming Lumber and Shingle Company, Markham, Wash., is building a new shingle mill.

The Pacific American Canning Company, Bellinghan, Wash., will increase the capacity of its plant.

The Whatcom Falls Mill Company, Whatcom, Wash., is increasing the capacity of its sawmill.

The Idaho Realty and Power Company, Dixie, Idaho, will build a hydroelectric plant in the spring.

J. W. Seales, Spokane, Wash., is planning for the erection of a canning factory at Marshfield, Ore.

George D. Brown, Chelan Falls, Wash., will build power plants at this place and Entiat, in the spring.

The city of Lewiston, Mont., is contemplating the installation of a waterworks system to cost $100,000.

The shingle mill and planing mill of the Waldport Lumber Company, Toledo, Ore., was destroyed by fire.

The Stack-Gibbs Lumber Company, Cœur d'Alene, Idaho, will erect a large sawmill on the Spokane river.

The Richvale Land Company, Richvale, Cal., will install a sewer system, water system and septic tank.

The Bellingham Canning Company, Bellingham, Wash., will build a new canning factory to cost about $25,000.

The Lane County Asset Company, Marshfield, Ore., will build an electric railroad from Eugene to Florence.

The Spokane Hide and Tallow Company, Spokane, Wash., will soon commence the erection of a new factory.

The Lester W. David Company, Ocean Falls, B. C., will build a new sawmill and pulp mill in this vicinity.

The city of Stockton, Cal., will expend $117,000 on improvements in its sewer system. Bonds will be voted.

The Lovegren Lumber Company, near Gaston, Ore., will build a new mill of 150,000 feet capacity in Cherry Valley.

The Gem Irrigation district, Caldwell, Idaho, will install a pumping plant to irrigate a tract of 29,500 acres.

The Lewiston-Clarkston Company, Lewiston, Idaho, is planning to install a waterworks system at Asotin, Wash.

The Spokane Asbestos Fire Brick Company, Spokane, Wash., will build a new plant; new machinery will be installed.

The city of Salmon City, Idaho, is contemplating improvements and extensions in its water system to cost $10,000.

The Pacific Telephone and Telegraph Company, Aberdeen, Wash., will build a new exchange building to cost $10,000.

The Idaho Pine Lumber Company, Dishman, Wash., is rebuilding its mill and box factory recently destroyed by fire.

The city of Brandon, Ore., will build a municipal waterworks system to cost $60,000. Bonds for this sum have been voted.

The Cottage Grove Light and Power Company, Cottage Grove, Ore., has been granted a franchise to operate in this city.

The city of Cheney, Wash., will expend $15,000 in improving its water system. Bonds for this sum will be voted.

The Chewalah Brick and Lime Company, Chewelah, Wash., will make extensive improvements and additions in its plant.

The Vance Lumber Company, Malone, near Elma, Wash., is building a new mill. The capacity will be 80,000 feet per day.

C. R. Wickes, Orland, Cal., has been granted a power franchise and will soon commence the erection of a power plant.

The International Lime Company, Sumas, Wash., will install a complete hydrating plant at its factory in the Columbia valley.

The North Pasadena Land and Water Company, North Pasadena, Cal., will make extensive improvements in its water system.

The Mortland Manufacturing Company (fruit products), North Yakima, Wash., will remodel and increase the capacity of its plant.

The U. S. Cashier Company, Portland, Ore., has purchased property at Kenton, and will build a factory. Plans are being prepared.

The Escondido Fruit Growers' Association, Escondido, Cal., will build a new packing house. Modern machinery will be installed.

The Pacific Power and Light Company, Portland, Ore., is rebuilding its power plant on White river; $50,000 will be expended.

A. H. Hill, Porterville, Cal., operating on property in the Woodville district, will install many new pumping plants in this section.

The Booth-Kelly Lumber Company, operating mills at Coburg and Wendling, Ore., is overhauling its plants and making improvements.

The building to be erected at Pasco, Wash., by the Olympia Brewing Company, Olympia, Wash., will be equipped with a refrigerating plant.

A. C. Tracy, secretary of the Pratt (Kan.) Commercial Club, has completed arrangements for the establishment of a large broom factory.

The Kline Invalid Bed Company, Wilmington (Los Angeles), Cal., is building a new factory. N. W. Kline is president of this company.

Fred Meier, Woodland (Yolo county), Cal., will build an alfalfa mill with a capacity of five tons per hour. Modern machinery will be installed.

It is announced that the Coachella Valley Cotton Company, Mecca, Cal., is contemplating the installation of a new cotton-gin some time in 1911.

The Colton Orange Growers' Association, Colton, Cal., will build an addition to its packing house; it will be equipped with modern machinery.

H. L. Scranton, Spokane, Wash., is planning for the erection of a factory at Sandpoint, Idaho, for the manufacture of iceless refrigerators.

Messrs. Thee & Graham, operating a lumber yard at Santa Ana, Cal., will erect a new building and equip it with modern woodworking machinery.

The King county (Washington) commissioners, Seattle, Wash., have requested the county engineer to estimate on a power plant for the county hospital.

A power plant will be installed by the county of Multnomah (Ore.) at the county farm, near Troutdale. Bridges & Webber, architects, Portland, Ore.

The El Sobrante Land Company, Los Angeles, Cal., is planning for extensive irrigation improvements on its 43,000 acres of property, near Riverside.

A power plant will be installed in the new building for the Pacific German Home to be erected at Hollywood, Cal. J. P. Krempel, architect, Los Angeles, Cal.

The O'Connell Lumber Company, Winlock, Wash., will build a new plant, including sawmill, planing mill and box factory. Capacity about 150,000 feet per day.

A sawmill of 20,000 feet daily capacity will be built on the White Salmon river, Wash. Mrs. R. Mathews, Husum, Wash., is at the head of this enterprise.

The substation of the Southern California Edison Company (Los Angeles, Cal.) at San Pedro, Cal., was destroyed by fire. The electric equipment was demolished.

The Sacramento & Sierra Railway Company, Sacramento, Cal., is contemplating the erection of a large power plant on the American river, near Placerville, Cal.

The new polytechnic school to be erected at Ventura, Cal. (N. F. Marsh, architect, Los Angeles, Cal.), will have workshops for manual training and a gas-engine laboratory.

The Inspiration Copper Company, operating the Joe Bush mine, Globe, Ariz., has commenced the erection of a carpenter shop on this property; modern equipment will be installed.

The Quincy Valley Water Users' Association, Morrison, Wash., is planning for extensive irrigation work. About $25,000,000 will be expended. H. A. Ternany, secretary of company.

The Santa Fe Steam Laundry Company, San Bernardino, Cal., has increased its capital stock to $50,000, and will make extensive enlargements in its capacity. New machinery will be installed.

James H. Jones, Reno, Nev., and associates have purchased gypsum property in Washoe county, for about $100,000. Extensive operations are planned; a railroad will be built from Gerlach to the site.

The Cœur d'Alene Paper Company (William Dollar, Cœur d'Alene, Idaho, president) has purchased property in northern Idaho, and will build a mill for the manufacture of paper to cost about $200,000.

W. H. Hickey, Ely, Nev., is at the head of a large irrigation enterprise, covering 200,000 acres, in the vicinity of Spring Valley, White Pine county; pumping equipment, etc., will be installed on a large scale.

The Wheeler Irrigating Company has been incorporated at Lakeview, Ore., by J. T. Wheeler, Jr., and Thos. S. Farrell, with a capital stock of $25,000. The company will operate extensively in this vicinity.

The American Fish and Oyster Company, San Francisco, Cal., will erect a new market building, at San Francisco, Cal., to cost about $30,000. Modern equipment will be installed, including a refrigerating system.

The Chehalis Fir Door Company, Chehalis, Wash., is building a new factory at McCleary, including a modern planing mill; all tools will be motor driven. The capacity of the plant will be about 2500 doors per day.

The company is planning to expend a like amount on a substation at Walla Walla, White Bluffs, Toppenish, North Yakima, Wash., and will erect smaller substations at Touchet, Richland, Benton City and Hanford.

CANADA

Portage La Prairie, Man., will install a complete lighting plant.

Edmonton, Alberta, will spend $75,000 for electrical pumping machinery.

The Canadian Box and Barrel Company, of Pembroke, will double its plant.

The Toronto Type Foundry, of Toronto, will build a branch factory at Regina.

The Aluminum and Crown Stopper Company is building a large factory in Toronto.

Parker Brothers are rebuilding their large mill, which was destroyed by fire at Alliston, Ont.

The Partington Pulp and Paper Company, of St. John, N. B., will equip a large new factory.

The big mills of M. F. Schurman, at Summerside, P. E. I., destroyed by fire, will be reëquipped.

Vancouver, B. C., will spend $100,000 installing a waterworks plant for the suburbs of Hastings.

M. F. Beach, of Iroquois, Ont., will install a big plant for developing power on the Madawaska river.

The large Bernard Creamer woodworking mills, at Souris, P. E. I., destroyed by fire, will be rebuilt at once.

Victoria, B. C., is in the market for $10,000 worth of water meters and $80,000 worth of 4-, 6-, 8- and 12-inch steel tubing.

MINING

The Nevada Eagle mine, Eldorado, Nev., will install a new mill.

The McAllister mine, Sandon, B. C., is planning for extensive operations.

The Cajones mines, state of Oaxaca, Mex., is planning to install a large mill.

The Lucy Grey mine, in the Las Vegas district, Nev., is planning for the erection of a 50-ton mill.

The Rainbow mine, in the Morman Basin district, Oregon, is planning for extensive development work.

The McKinley Mining Company, Orient, Wash., will expend $25,000 on improvements in its property.

The Iron Dyke mine, on Snake river, Baker City district, Ore., will build a 200-ton concentrating plant in 1911.

The Dutch & Sweeney mines, Quartz, Tuolumne county, Cal., will increase the capacity of its 100-stamp mill.

The Emmons property, Taviche district, Oaxaca, Mexico, will add cyanide equipment to its mill in the near future.

The Afterthought Copper Company, operating at Ingot, Shasta county, Cal., is planning for extensive development work.

The Hedrazzini Mining Company, operating the Chispas mine, Cananea district, Mexico, is installing new machinery.

The Santa Fe Villa Zaragona property, Parral district, Mexico, will install new pumping equipment in the near future.

The Buxton-Taylor Company, Oroville, Wash., is contemplating the installation of a concentrator and smelting plant.

The Grey Eagle Mining Company, operating in the Battle Mountain district, Nev., will erect a 20-stamp mill in the spring.

It is announced that the Colorado-Toledo Mining Company, operating at Argentine, Summit county, Cal., is building a new mill.

The Pittsburg Red Top Company, operating in the vicinity of Battle Mountain, Nev., is having plans prepared for a 20-stamp mill.

The Tiptic Combination Mining Company, operating near Park City, Summit county, Utah, will install electric equipment at its mines.

C. M. Becker and W. W. Travell, operating in Ixtlan del Rio section, Tepic, Mexico, have commenced the construction of a reduction plant.

The Chief Consolidated Mining Company, Eureka district, Juab county, Utah, will install new equipment, including an air compressor.

The Alvarado Mining and Milling Company, operating the Palmilla mine, Parral district, Mexico, is planning for extensive development work.

J. F. Hopkins, Tucumcari, N. M., operating the Cap Rock mines, is contemplating extensive development and will thoroughly equip the mines.

J. M. Blood, general manager, 1910 Mining Company, Winnemucca, Nev., wants catalogs and prices on four-cylinder gasolene hoist, air compressors, drills, etc.

The Gold Ridge Mining and Milling Company, operating the Poeth mine, near Carrville, Trinity county, Cal., will install new air compressors in 1911.

The El Dorado-Placer Mining Company, operating on the American river, El Dorado county, Cal., is contemplating the installation of a new gold dredge during 1911.

The Big Eye Mining Company, operating near Yuma, Ariz., is planning for extensive improvements; a power hoist, air compressors, machine drills, etc., will be installed.

The Laurel Gold Mining, Milling and Leasing Company, Laurel, Nev., expects to install a four-cylinder hoist and a belt-driven air compressor about June 1. C. A. Smith, general manager.

The Kimberly Consolidated Mining Company, Kimberly, Shasta county, Cal., is installing a 20-stamp mill; the company is planning to double this capacity almost immediately.

The Natomas Consolidated Mining Company, operating near Oroville, Cal., is building a new dredge. The company is also planning to install another dredge later in the season.

The Western Smelters' Corporation, Carson City, Nev., is making extensive improvements in its plant and adding new machinery preparatory to building its contemplated power plant, ground for which is being cleared.

Business Items

Pawling & Harnischfeger Company, Milwaukee, Wis., announces the opening of a branch office at 533 Baronne street, New Orleans, La., under the management of T. W. Waddell.

Garwood Electric Company announces having appointed Henry Widmer, 731 Union street, New Orleans, La., as agent for the sale of its product in the State of Louisiana, and Milton S. Nettleton, 29 College street, New Haven, Conn., as its agent for the city of New Haven and surrounding territory.

The Sullivan Machinery Company announces the appointment of Howard T. Walsh as manager of its London office. J. C. West, sales engineer at the company's general offices in Chicago for the past ten years, replaces Mr. Walsh as Pacific coast manager. This company also announces the establishment of a branch office at Spokane, Wash., to be in charge of Austin G. Hoy.

Announcement is made of the organization of the Busch-Sulzer Brothers-Diesel Engine Company, at St. Louis, Mo. The capital stock of the new corporation is $2,100,000, and the officers and board of directors are as follows: Adolphus Busch, president; August A. Busch, first vice-president; James R. Harris, second vice-president and general manager; Edward A. Faust, E. D. Meier, Robert Sulzer, Eugene Angert, Rudolph Diesel, Daniel N. Kirby. The new company is to take over the business of the American Diesel Engine Company, and the present plans involve the erection of a new plant, probably in St. Louis, the estimated cost of which is placed at $1,000,000.

Trade Catalogs

Northern Engineering Works, Detroit, Mich. Catalog No. 25. Cranes. Illustrated, 56 pages, 6x9 inches.

Triumph Electric Company, Cincinnati, Ohio. Bulletin No. 451. Transformers. Illustrated, 12 pages, 7x10 inches.

C. S. Dodge, 67 Payne street, Lowell, Mass. Circular. 24-inch Lowell heavy-duty backgeared crank shaper. Illustrated.

Rockwell Furnace Company, 26 Cortlandt street, New York. Bulletin R. Combination tool-room gas furnace. Illustrated.

United Nut Lock Company, Springfield, Mass. Catalog. "Hugtite" nut locks. Illustrated, 8 pages, 3½x6 inches, paper.

The Curtis & Curtis Company, Bridgeport, Conn. Catalog. Pipe-cutting and threading machinery. Illustrated, 7½x10 inches, paper.

The Whitman & Barnes Manufacturing Company, Akron, Ohio. Catalog No. 75. Wrenches. Illustrated, 32 pages, 3½x6 inches, paper.

The Grant Manufacturing and Machine Company, Bridgeport, Conn. Catalog. Grant rotary rivet-spinning machine. Illustrated, 32 pages, 3½x6 inches, paper.

Massachusetts Saw Works, Chicopee, Mass. Booklet. "The Gentlemen from Missouri—A Book for Doubters." History of the Victor hack-saw blades. Illustrated, 20 pages, 3½x6 inches.

General Electric Company. Bulletin No. 4685. Belt driven alternators. Illustrated, 12 pages, 8x10½ inches. Bulletin No. 4804. Direct-current generating sets. Illustrated, 12 pages, 8x10½ inches. Bulletin No. 4810. Portable and stationary air-compressor sets. Illustrated, 8 pages, 8x10½ inches.

Forthcoming Meetings

American Supply and Machinery Manufacturers' Association, National Supply and Machinery Dealers' Association and Southern Supply and Machinery Dealers' Association; joint annual convention, Hotel Seelbach, Louisville, Ky., April 3-5, 1911. F. D. Mitchell, secretary, 309 Broadway, New York City.

National Metal Trades Association, annual meeting, April 14, 1911, New York City, Hotel Astor. Robert Wust, commissioner, New England building, Cleveland, Ohio.

American Foundrymen's Association, annual convention, Pittsburg, Penn., May 23 to 26, 1911. Richard Moldenke, secretary, Watchung, N. J.

American Society of Mechanical Engineers; monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month, Young's hotel. D. F. S. Clark, secretary, 141 Milk street, Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. E. C. Bliss, president, 91 Sabine street, Providence, R. I.

New England Foundrymen's Association; regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania; monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland; monthly meeting third Saturday. Philip Frankel, secretary, 310 New England building, Cleveland, O.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1735 Monadnock block, Chicago, Ill.

Philadelphia Foundrymen's Association; meetings first Wednesday of each month, Manufacturers Club, Philadelphia, Penn. Howard Evans, secretary, Pier 45 North, Philadelphia, Penn.

WANTS

Rate 25 cents per line for each insertion. About six words make a line. No advertisements abbreviated. Copy should be sent to reach us not later than Friday for ensuing week's issue. Answers addressed to our care, 505 Pearl Street, New York, will be forwarded. Applicants may specify names to which their replies are not to be forwarded, but replies will not be returned. If not forwarded, they will be destroyed without notice. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. Only bona-fide advertisements inserted under this heading. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for situations.

Miscellaneous Wants

Caliper catalog free. E.G.Smith, Columbia, Pa.

We buy or pay royalty for good patented machine or tool. Box 282, Amer. Machinist.

Wanted—Work for screw machines and gear cutter. Box 775, American Machinist.

Light, fine machinery to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

Wanted—Contract work or medium weight specialties to build. Wm. A. Cather, Pottsville, Penn.

Light and medium weight machinery and duplicate parts built to order; tools, jigs, etc. MacCordy Mfg. Co., Amsterdam, N. Y.

The Brunswick Refrigerating Co., of New Brunswick, N. J., are prepared to take on one or more manufacturing propositions.

Wanted—To purchase established general machine shop in live town of 5000 to 10,000; give name of banker. Box 457, Am. Mach.

Patents. C. L. Parker, Patent Attorney, ex-examiner Patent Office, 990 G St., Washington, D. C. Write for Inventor's Handbook.

Agency for machinery and tools, covering Pittsburg district, is wanted by well known and established engineer. "Engineer," Box 491, American Machinist.

Wanted—An article to manufacture suitable for the railway, automobile or hardware trade; must be patented and exclusive. Address Box 356, American Machinist.

Let us bid on your duplicate screw machine work, or anything made on an automatic screw machine; 30-horsepower electric motor for sale. "J. S. J.," Amer. Mach.

Tools, dies, jigs and light and medium weight machinery designed and built to order; duplicate parts, either machined or die cast. Precision Die Casting Co., Syracuse, N. Y.

Light and medium weight machinery and small parts in quantities; also screw machine and punch press work, tools, jigs, dies and high grade machinery. The Elgin Tool Works, Elgin, Ill.

Large English firm of machine tool importers having showrooms and offices in Great Britain, France, Germany, Italy, India and Japan is wanting good agencies for machine tools of all kinds. Box 189, Amer. Mach.

Cummings Machine Company, 238 William street, New York. Estimates given on automatic machinery, bone hardening, grinding and jobbing; uptodate plant; highest grade work done with accuracy and despatch. 'Phone 5592 Beekman.

Welding by oxyacetylene process; special attention given to repairs of machinery and castings of all kinds; large experience in difficult experimental work; structural shapes welded together. Write for particulars. Krajewski-Pesant Company, 54 Beard St., Brooklyn, N. Y.

Factory Facilities Wanted—Small electrical or mechanical articles to manufacture for selling agents; first class factory and equipment already engaged in similar work; practical superintendent in charge. Address, with and for particulars, Factory, Box 167, Boston, Mass.

Manufacturer of telegraph machines, adding machines, taxameters, accurate interchangeable parts, dies and special tools, invites orders for similar special manufacturing. The Universal Telegraphic Company, Successors to the Rowland Telegraphic Company, Baltimore, Md.

Wanted—Partner with moderate capital in a growing business, no incumbrance, in a manufacturing center in Canada; must possess a thorough knowledge of how to produce small, interchangeable parts requiring accurate assembling for mechanics' tools; also gear cutting. Apply G. Sharp, 200 Mance St., Montreal.

Wanted—Factory location; we are looking for a new factory location for our machine shop and foundry; we build heavy machinery and must have a side track and buildings suitable for electric traveling cranes; any factory sites or buildings that any city or commercial club has to offer will be considered. Bertsch & Co., Cambridge City, Ind.

A small, progressive machine shop manufacturing a line of shop specialties for the past year is desirous of increasing the business and would consider a proposition from either a mechanical or business man who could invest $10,000, which would secure a one-third interest; this is an opportunity for a good investment either with or without services. Address "R," Gen. Del., Meadville, Pa.

Leading German electric steel works with a really first class product are about to introduce their steel into America and to establish an agency there; manufacturers of motor cars, ball bearings, tools of all kinds, who are interested in first class steel, are invited to ask for particulars and prices; gentlemen with excellent knowledge of the trade and first class connections among the consumers able to take up the agency and make a full success of it should apply at once; authorized representative will be in the United States next fall. Box 474, Amer. Mach.

Help Wanted

Classification indicates present address of advertiser, nothing else.

CANADA

Draftsmen, experienced on gun, typewriter or sewing machine tool and fixture work; men with shop experience preferred. Box 477, American Machinist.

CONNECTICUT

Wanted—A first class temperer, with experience in hardening German high-grade steel; permanent position in Connecticut; give age and references. Box 446, Am. Mach.

Wanted—Mechanical draftsman with good knowledge of detailing from general layouts; correctness in dimensions and notes very essential; light and medium automatic machinery; state age, experience and salary expected. The Manville Brothers Company, 27 Benedict St., Waterbury, Conn.

FLORIDA

Wanted—$900 shop foreman for southern university; preferably a recent graduate with

experience in wood, or iron, or both. Full particulars to Box 490, AMER. MACHINIST.

INDIANA

Wanted—A chief inspector by a large automobile company in Middle West; must have had extensive experience as an inspector in a position of responsibility; good salary and steady employment to the right man; none but high class energetic man need apply. Box 447, AMERICAN MACHINIST.

Wanted—Foreman for forge shop of large old established manufacturing plant, doing their own forging and general blacksmith work; must be thoroughly qualified on such work and on heat treating of steel and alloyed metals for crank shafts, small bushings, pins, etc.; shop well equipped and located in first class city. Box 476, AMER. MACHINIST.

IOWA

Wanted—Draftsman, experienced in designing dies for heavy machine work; prefer one acquainted with hydraulic machinery. Box 357, AMERICAN MACHINIST.

MASSACHUSETTS

Wanted—Traveling salesman (machinery or hardware) to sell cast bronze name plates on commission as a side line. Murdock-Reed Co., 127 Federal St., Boston, Mass.

MISSOURI

Wanted—An A-1 mechanical draftsman; general machinery; state age, experience and salary expected. Curtis & Company Mfg. Co., St. Louis, Mo.

NEW YORK

Wanted—Mechanical draftsman, who has had experience in designing woodworking machinery; A-1 man required; state age, experience and reference. Box 492, AM. MACH.

Wanted—First class designing draftsman, experienced on melting, bar heating and annealing furnaces (oil fired), rolling mills and wire drawing machinery; state experience, references, salary required. Address The United States Aluminum Co., Massena, N. Y.

Machine tool salesman, with mechanical training; such with theoretical and practical knowledge of gear cutting machinery preferred; state salary, experience, former occupation and territory in which best acquainted. Box 386, AMERICAN MACHINIST.

Wanted—Mechanical engineer to take charge of the design and supervise the making of special fixtures, tools and gages, for the interchangeable manufacture of small mechanisms in plant employing over 1000 men; to handle departments satisfactorily man should be familiar with master plate methods used in manufacture of watches, clocks, guns, sewing machines, etc.; executive ability and good judgment in handling men a requisite; state experience in detail, give age and references. Box 452, AMERICAN MACHINIST.

OHIO

Wanted—A gas producer mechanical engineer, who is familiar in installing gas producers. Box 473, AMERICAN MACHINIST.

Wanted — Mechanical superintendent for large engineering works; must have thorough knowledge of and wide experience in modern manufacturing methods. Apply Robert Wuest, Commissioner, National Metal Trades Association, 1405 New England Building, Cleveland, Ohio.

Wanted—First class machinists, toolmakers, die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood and metal patternmakers, brass polishers, buffers, finishers, millwrights, hammermen and blacksmiths, who wish to increase their opportunities, to register with the free Employment Department of the National Metal Trades Association, New England Building, Cleveland, Ohio.

Wanted—On account of increasing business company operating six automatic screw machines (Acme and Cleveland) is in need of general manager for that department; applicant must have good education and be capable of taking entire charge of all parts of the work from ordering material to shipping finished product; best of references required and would prefer man who could make a small investment in the business, but that is not essential. Box 418, AMER. MACHINIST.

PENNSYLVANIA

Wanted—Assistant foreman who can get results with high speed steel tools in lathe and boring mills. Box 487, AMERICAN MACHINIST.

Wanted—A first class machine tool designer; prefer one experienced on grinding machinery. Box 484, AMERICAN MACHINIST.

Wanted—Foreman in assembling department with experience in light machinery; one with energy and push, used to accurate work. Box 486, AMERICAN MACHINIST.

Several draftsmen wanted; applications solicited from men with either ordnance, mechanical-electrical, or mechanical structural experience; state fully, age, experience, education and salary expected. Box 429, AM. M.

The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

WEST VIRGINIA

Wanted—Man with considerable mechanical experience to superintend large plant manufacturing principally tin cans; capable of successfully handling three to four hundred hands; must have experience and executive ability; reference. "Cans," AMER. MACH.

SITUATIONS WANTED

Classification indicates present address of advertiser, nothing else.

CONNECTICUT

An A-1 tool room foreman; excellent reputation; expert on tool and die work; thoroughly experienced in manufacturing by uptodate methods and installing labor saving devices. Box 475, AMERICAN MACHINIST.

Mechanic, experienced as foreman and superintendent, of proven ability to reduce costs and improve product, especially on medium and small, accurate interchangeable work, is open for engagement. Box 497, AM. MACH.

NEW JERSEY

A-1 University of Pennsylvania man, age 33, desires a change; nine years' broad experience. Box 501, AMERICAN MACHINIST.

Mechanical superintendent wishes change; not a reorganizer, but an efficiency increaser; can get results from help, improve manufacturing methods and simplify clerical systems. Box 453, AMERICAN MACHINIST.

Position as foreman of grinding and polishing department who has handled men successfully for 14 years; thoroughly practical and up to all modern manufacturing methods. Box 481, AMERICAN MACHINIST.

Machine shop foreman wishes to make a change; A-1 hustler; can handle large force with ability; 15 years' experience on most uptodate methods; six years with present firm. Box 482, AMERICAN MACHINIST.

Tool designer and experimental draftsman wishes change; all-around toolmaker and designer on special machinery, tools, jigs, fixtures, punch and die work; technical training; 10 years' practical experience; reference. Box 496, AMERICAN MACHINIST.

Superintendent, with established reputation for getting maximum production, at minimum costs, would like to consider a change; good reasons given; at present successfully engaged as superintendent of well known concern, manufacturing most intricate and highest quality product, where interchangeability is absolutely necessary; 35 years of age, and a hustler; wide experience in factory organization and piece work systems. Box 480, AMERICAN MACHINIST.

NEW YORK

Designer, experienced on automatic and special machinery, capable of taking charge of work. Box 503, AMERICAN MACHINIST.

Draftsman, mechanical technical graduate, three years' experience detailing and tracing various machines. Box 500, AMER. MACH.

Superintendent and factory manager, with large experience as executive; practical machinist and foundryman; fully qualified to take charge. Box 444, AMER. MACHINIST.

Sober, industrious technical man, 10 years' shop and six years' drafting room experience, desires position as superintendent; New York City preferred. Box 478, AMER. MACHINIST.

Mechanical expert desires position developing and improving equipment, or foremanship; would consider salary, or salary and percentage on cost reduction; go anywhere. Box 502, AMERICAN MACHINIST.

Commercial engineer, thirty-five years old, well connected at present, is looking for more responsible position as manager, or in charge of sales or production, where field will widen from personal effort. Box 338, AM. MACH.

Steam hammer expert, who has had practical and successful experience, can handle engineering and sales end of this or steam-hydraulic presses, would make change if better than present connections. Box 471, AM. M.

A-1 mechanic, uptodate in modern methods; 22 years' shop experience, 10 years in executive position, wishes position as tool room or general machine shop foreman; good references; location New York, Connecticut or Rhode Island. Box 387, AMER. MACHINIST.

OHIO

Position as cost accountant and premium system man in foundry and machine work; 20 years' experience; reference if required. Address 130 Schæffer St., Dayton, Ohio.

A general foreman in the machine and engine line, now holding such a position, desires a change; a shop desiring piece work preferred. Box 472, AMERICAN MACHINIST.

Practical works manager or superintendent with twenty years' experience with representative concerns, will make a change about March 1; successful organizer, systematizer and shop administrator; correspondence solicited. Box 449, AMERICAN MACHINIST.

Position as shop superintendent or manager; have held executive positions in designing and manufacturing for 12 years; am experienced in handling men and have always shown results; with present company 10 years; technical graduate; 34 years of age. Box 493, AMERICAN MACHINIST.

PENNSYLVANIA

Foreman tool room or general shop foreman, uptodate in modern shop methods, and can produce results; good references; age 32. Box 498, AMERICAN MACHINIST.

A-1 tool and jig designer, six years' experience, capable of taking charge and producing results; references; 26 years of age, married. Box 479, AMERICAN MACHINIST.

Tool or model making foreman, experienced cash registers, typewriters and adding machines, solicits correspondence from uptodate firm in need of a live man. Box 499, AM. M.

Machine shop foreman, uptodate in modern shop methods, ten years' experience as foreman and rate setter, age 38, now employed, desires change. Box 488, AMER. MACHINIST.

Mechanical draftsman, age 21, two and one-half years' electro-mechanical experience with highest class companies, desires change; small company preferred; moderate salary. Box 494, AMERICAN MACHINIST.

Foreman of patternshop of large job manufacturing company, desires change; fifteen years' experience, seven years foreman; can estimate work and have executive ability. Box 489, AMERICAN MACHINIST.

General manager, superintendent, production specialist; over 20 years' machine shop, foundry and office experience on interchangeable system of tool, machinery and mechanical specialty manufacturing; age 37; references. Box 483, AMERICAN MACHINIST.

Master mechanic and assistant superintendent for large machine shop with long and valuable varied experience, is open for engagement; experience in estimating, maintenance of plant, motive power and tool departments; thoroughly familiar with modern apprentice systems and very successful in handling men; record of the very best. Address "Mechanic," AMERICAN MACHINIST.

SOUTH DAKOTA

Metal patternmaker wants position with firm requiring close and exact work. Box 485, AMERICAN MACHINIST.

VERMONT

Position as foreman desired by all-around machinist and toolmaker; age 27; good education; 10 years' experience in jobbing and manufacturing shops; good knowledge of drafting and designing, also fair knowledge of foundry work; can handle men; East or Middle West preferred. Box 456, AM. MACH.

FOR SALE

Patent rights for sale on improved micrometer boring tool holder. Box 470, AM. MA.

Bargain—Niles 10-foot standard boring and turning mill, belt driven, takes 66 inches under tools; table diameter, 96 inches; bar travel, 42 inches. Apply Box 495, AM. MA.

For Sale—Various lots of high speed metal slotting saws and cutters, all special sizes; send in your specifications; can make very attractive prices. Stewart & Clark Mfg. Co., Chicago.

For Sale—One motor generator set, 1000 amperes, direct connected to 10-horsepower motor, including base plate and accessories; one 42-inch centrifugal extractor, self-balanced, complete; both absolutely new. For further information, address Fels & Co., 73d and Woodland Ave., Philadelphia, Penn.

An opportunity to start a machine shop; we offer one of our departments for sale, the one used to establish our business; it is small and profitable work, but as we are devoting ourselves to heavier work, we offer to sell for $2000, all the drawings, patterns, and stock of finished and partly finished parts and rough material (inventories over $3000), circulars, electrotypes, special machinery and fixtures, and an established trade. Address Sipp Machine Company, Paterson, N. J.

Talks With Our Readers

By The Sales Manager

December and January are the busiest months of the year for most publishers—from the subscription standpoint.

Although our subscription business is getting to be more and more distributed throughout the whole year.

There were 7143 changes made during December and January in our subscription list—and that doesn't include our foreign circulation, which goes by freight, and the news company, which goes in bulk.

Where there are so many new names to be added, changes in addresses to be made, there are bound to be some errors—even when we have 35 trained girls to look after the lists of our three papers.

But we are glad to say that we received fewer kicks this year than ever before.

And yet we invite kicks.

If you don't get our paper regularly and promptly, we want to know it.

* * *

We are proud of our subscription list.

Regarded merely as names they are worth less than the stencils they are stamped on.

Even regarded as names of representatives of a defined industry, they are not worth much more.

But regarded as names of men who are paying from $1.00 to $10.00 to get on that list, they are invaluable.

The names on our subscription list are there because you want and pay for what is sent to you—you are financially interested in making sure that your address is properly kept up-to-date.

Remember, there's a big difference between a subscription list and a "mailing list."

An ordinary mailing list is just as dangerous to a sales department as an inflamed appendix is to the human body—both should be cut out.

Many manufacturers realize this and ask for the use of our subscription list.

This we always absolutely refuse.

Because we have no moral right to make such use of it.

When you give us your name and address we assume that it is for the sending of the AMERICAN MACHINIST and matter pertaining thereto and *for no other purpose.*

But suppose we did permit our advertisers, say, to address you direct. You would be swamped with circular matter. It would be a nuisance to you and a loss to the sender, and both of you would be sore on us in the end.

How much better it is for you to use your selective power.

You realize that the selling section of the AMERICAN MACHINIST contains the announcements of the responsible concerns in the machine-making field who want your business enough to ask for it.

In all of these you are not interested. If those concerns in whose *product* you are interested have something worth sending for and *say so*, we know you'll ask for it in your own good time and way.

And profit thereby.

* * *

Only reliable products can be continuously advertised.